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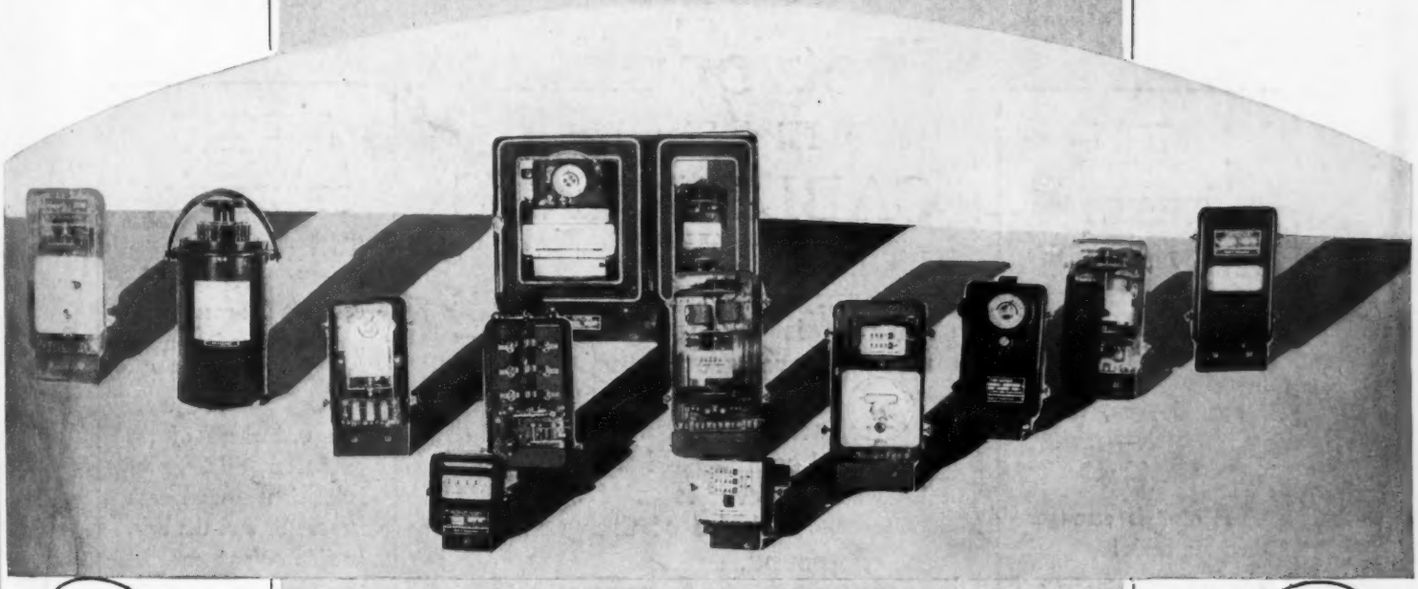

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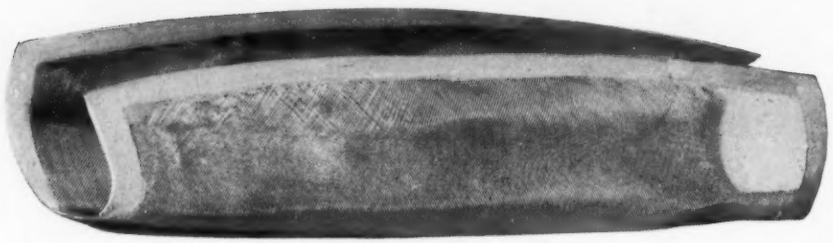

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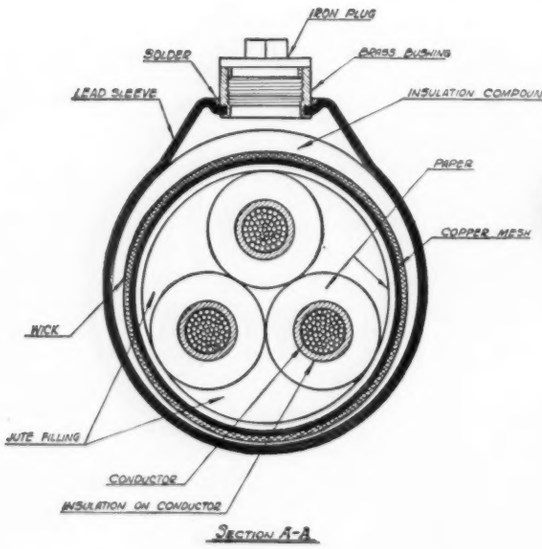

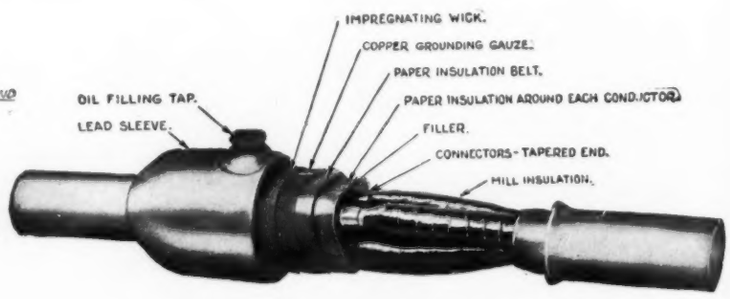

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Electrical World

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W. H. ONKEN, JR.
Editor

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Why We Need Engineers

EVERY one realizes that advances in civilization place increased burdens on engineers. But it is seldom that their responsibilities and obligations have been better stated than in a recent address by W. E. Wickenden, director of investigations for the Society for the Promotion of Engineering Education. He pointed out that the growth of urban population has been seven times the rural growth during the last quarter of a century. This means the crowding of people into regions with narrowed margins of human accommodation and absolute dependence on continuous service of water, fuel, electricity, communication, transportation and sanitation. The only possible answer to the problem of the big city is better engineers.

The great development of interconnection, with its bearings on power supplies for the nation and upon the social and economic progress of the people, imposes a task that requires engineering talent. Along with more power comes also the need for better utilization of power in production. Here the engineer must balance the pressure of production against human wellbeing in order to reach a proper solution. The co-ordination of industry whereby scientific production, distribution and utilization are attained is a task for engineers because engineering is the foundation of these activities.

Further elements in the situation are the replacement of sporadic invention by co-ordinated researches, the conservation of diminishing natural resources and the conservation of men in a country whose immigration policy and birth rate tend to keep men scarce. The maximum utilization of power, men and machinery must be had if our present economic position and our present standards of living are to be maintained. If better engineers are needed to do these things, then it is well worth while for this country to give aid, advice and encouragement to the source of engineers—the engineering colleges.

Great Britain's Power Scheme

FOR years Great Britain has been dreaming of the time when her great cities and industries would be supplied with electricity from huge modern strategically located power stations.

She has seen her great competitor, Germany, cope with the problem of cheap and abundant power supply, to the advantage of her people and her industries, and the high living standards and comforts of America—made possible chiefly through the utilization of electricity—have always made a deep impression on her leading statesmen. Lloyd George two years ago made a striking and eloquent plea for the electrification of Great Britain, and now Stanley Baldwin, the present Prime Minister, gives utterance to a somewhat similar plan for the development of the electrical industry of that nation as a basis for a great social and industrial transformation. There is no doubt in the minds of thinking Englishmen that Great Britain lags behind other countries, especially the United States and her own colony Canada, in electrical development; but how to effect a remedy is the great problem.

Great Britain's engineers are not lacking in skill and vision. On the contrary, they led in the development of electricity and still rank among the best that the world possesses. If there be any lack at all, it is in commercial exploitation and in a determination to surmount great obstacles, for the task is not so easy as many imagine. The basic legislation of 1882 governing the establishment and operation of electric light companies was a tremendous handicap to any great electrical development in Great Britain, since it expressly prohibited consolidation and co-ordination of facilities. Vested interests must also be considered, and to overcome them is as difficult a maneuver as it is for a camel to pass through the eye of a needle. The electricity commissioners of Great Britain have been hard at work for a number of years evolving a workable scheme of co-ordination and standardization, but so far they have made little impression because of lack of co-operation on the part of the public utility companies. If the Prime Minister succeeds in bringing only partial order out of the present muddled situation, he will have done a great service to Great Britain and to its people, for greater electrification means better living conditions, cleaner cities, more productive and efficient industries and contented labor. These are worth striving for in any country, and doubly so in Great Britain.

The Capitalization of Major Interruptions

"LEAST said soonest mended" is no longer the slogan of a progressive public utility when overtaken by the misfortune of widely interrupted service. These occurrences, like other accidents, happen in the best regulated of electrical families, and when they do come something more than the restoration of that service is due the public. Some of the best brains in the industry are constantly at work to prevent failures in the supply of electricity, but even yet a widespread cut-off of light and power occasionally mars the normal record for at least a short period. Some companies seem to be more fortunate than others in this respect, but, granting the vital importance of highest-grade engineering and operation, the fact remains that perfect service cannot be absolutely insured in this any more than in other fields of human activity.

In synchronism with efforts of the utility organization to restore service should function its authorized publicity representative. Putting back the service rightly takes precedence over all other activities, but the public is entitled to reasonable information from a responsible source even while the load dispatcher is

speeding motor trucks to the point of trouble and ordering relay power into the system. Reasonable information at this stage of affairs may be limited to the barest announcement of the location of the cause of the failure, if this be known. The effects of shutdowns are now so far-reaching that all proper effort should be made to give the customer and the inquiring public something definite in information without breaking into the work of restoration. This can be done in a well-organized company. As the work proceeds the time soon comes when the information available is greater in volume, but good judgment will decide how much of it to use. When service fails over any extended district, the public quickly gets into an extremely irritable mood; it is not much interested in the cause of the trouble, but wants service at the earliest possible minute. A definite answer, however, must be given to inquiries in justice to the operating company, enabling even the utterly untrained layman to visualize the fact that some specific kind of equipment has quit work, or that in some specific place a failure has occurred that is responsible for his situation.

It goes without saying that interruptions should be capitalized, in the sense of preventing their repetition, by studying them from inside the company promptly and intensively. The most important lessen is that pointing toward future prevention. Depending upon the extent of the failure and the completeness of information developing as to its cause, further comprehensive statements may go to the public, keeping technicalities to the minimum and in the discretion of the management. Unfortunate as service failures are from whatever cause, all major interruptions embrace opportunities to take the public into company confidence, and this aspect of the situation is but one degree removed in importance from those preventive engineering and operating analyses which are inextricably interwoven with good management.

Lighting Practice Should Be Designed for Subnormal Eyes

INTENSITIES of illumination are generally far from adequate for perfect or "normal" eyes. To increase the intensity to the high level most suitable and economically desirable for workers with normal vision is such a formidable task that little thought has been given to intensities necessary for the best efficiency of workers whose vision is subnormal. Apparently it has been assumed that subormal eyes are in an insignificant minority. However, the truth seems to be that the majority of workers' eyes are not perfect. Evidence to this effect has been accumulating of late through systematic eye examinations. Furthermore, it has been found that defective eyes require a greater intensity of illumination than normal eyes for seeing equally well, if this is possible at all. Correcting refractive errors by means of glasses is to some extent equivalent to increasing the intensity of illumination; but there is enough evidence to indicate that average eyes, even if corrected by means of glasses, require more light than normal eyes to attain equal facility in seeing.

Many statistics of eye examinations have been published, among the most recent being those obtained by the United States Public Health Service in two New York post offices. These are sufficient to illustrate the great prevalence of eye defects. The eyes of two thousand five hundred employees were examined with the following results: Normal or no defects, 17.1 per cent; one refractive error or more, 73.7 per cent; one inflammatory condition or more, 14.5 per cent; one muscular unbalance or more, 25.6 per cent; using glasses, 35.6 per cent. These percentages are startling, but approximately the same results have been obtained in other investigations, and a glance at the bespectacled contingent in any gathering is enough to convince one of their accuracy.

It is not surprising to those who have reached the "bifocal" stage in life that the percentage of nearsightedness and other eye defects increases as the average age of a group of workers increases. The percentage of normal eyes decreases rapidly beyond the age of forty years. In lighting practice this means that a relatively higher intensity of illumination should be supplied in those industries where skilled labor is important, because, in general and up to a certain point, skill is acquired with age. Thus it is seen that the prevalence of defective eyes over perfect or "normal" ones makes it necessary in the practice of lighting that special consideration be accorded to them.

Turning Points in Industrial Power Contracts

PAINSTAKING indeed are the analyses of cost demanded today in negotiating power contracts between central-station companies and industrial users of electricity whose heat balances necessitate close figuring to reach wise decisions as to purchasing energy. "Put your slide rules back in your brief cases, gentlemen, sharpen your pencils and get down to decimals," was the good advice of a prospective buyer of several thousand kilowatts of utility service during a recent conference. In such narrow-margin situations, involving very large blocks of power and enough process steam to move the balancing scale of opinion up and down with dangerous ease, turning points in sales thought are of no small importance.

Costs must be defined with extreme accuracy, but when this is accomplished weight must be given to other elements in the problem. In the most progressive power contract negotiations there is a marked tendency to overcome any price handicaps, if there be such, by striving to enrich the service to the utmost limit of the customer's welfare and the company's power. Even where the economic margin is on the central-station side of the table, service in all its best meaning is the chief emphasis of the utility representatives who seek to view the problem from the customer's standpoint no less than from their own. All that these men ask is a reasonable return on the cost of rendering this service, and the time-dishonored slogan of "charging all the traffic will bear" has no place in the thinking of the most progressive power sales departments. Instead, one finds them meeting the customer with proposals to render service improved to its maximum, and some of these proposals are very indicative of the new type of relationships coming into vogue between the utilities and their industrial patrons.

In one case, for instance, provision may be made for the correction of sub-normal frequency during the hours of factory operation, thereby enabling the customer to

recover from production slumps due to lowered speeds of motors from causes beyond momentary control. In another case the installation of increased capacity in feeders with more direct connection between the factory and the nearest substation or generating plant may be feasible. Again, an agreement to cut down demand charges in part during certain abnormal periods, as in the event of industrial strikes, may "humanize" a power contract and appeal to the executive and directing interests of the prospective customer as evidence that the utility is not after its pound of flesh. In still another case the arrangement of an interconnection between utilities may turn the scales in favor of purchased power through the weight of increased reliability of service thereby assured—and this is no theoretical point. Without such an interconnection a 10,000-kw. power contract recently negotiated in southern New England would probably have gone by the board. Willingness to submit contract rates and terms to review in reasonable ways, unhampered by the "legal complex" from which too many buyers and sellers of electrical energy have suffered in times past, is also a consideration belonging to these negotiations, whose nicely balanced turning points demand the cultivation of a closer *entente cordiale* in determining industrial power policies.

Of Rubber Plating and Matters Suggested Thereby

JUST now rubber is much to the fore in the public attention. The innocent bystander, nervously listening to the heated exchange of compliments between the British Lion and the American Eagle anent the latest bounce that rubber has taken, is helplessly trying to reconcile himself to the high price he will undoubtedly have to pay for his balloon tires next summer. He gets some comfort from the words of Dr. Charles H. Herty, who, in an address before the alumni of the Massachusetts Institute of Technology, intimated that the production of synthetic rubber was perhaps not so far in the dim remoteness of the future as one had always thought, as well as from news that American manufacturers are going to grow their own rubber. As a distraction from the gloomy contemplation of price in the near future and the feebly glimmering hope of synthetic production comes news of a process of rubber plating by electricity.

Rubber electroplating sounds like a contradiction of terms and like the very apogee of incongruity, yet it is a perfectly exact phrase describing an actual operation. It is possible on account of the fact that certain insolubles in water have the property of taking unto their emulsified particles a charge of electricity. As a pertinent instance, rubber particles in an alkaline emulsion are negatively charged, and it naturally follows that if an electric current is passed through the emulsion the negatively charged particles will travel toward and attach themselves to the positive electrode. By including in the emulsion various vulcanizing agents, properly selected so that their suspended particles are also negatively charged, a self-vulcanizing plating is deposited which is said to have all the properties of ordinary vulcanized rubber and in some respects, notably tensile strength, to be markedly superior to it.

The limit of thickness of electrically deposited rubber is about one-quarter inch, but thicker and perfectly homogeneous masses may be made by laminating sheets as they come from the plating bath. It is also possible to plate the rubber on fabrics by interposing them between the electrodes. As a matter of fact, rubber plating differs electrically in no respect from any metal plating. The credit for demonstrating this interesting fact belongs to S. E. Shepherd, assistant director of research, Eastman Kodak Company.

Should the Central Station Co-operate in the Sale of Radio Devices?

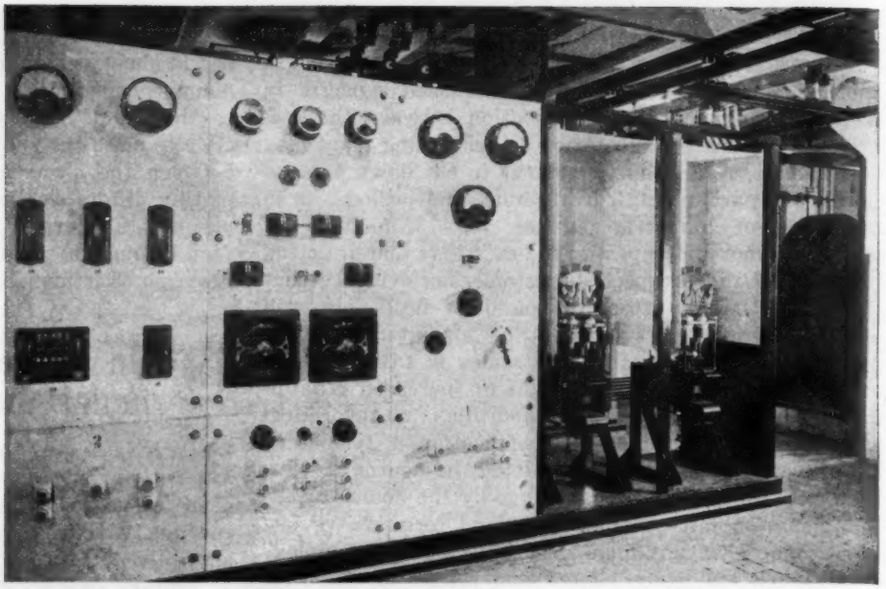
REVENUE to the central-station company from socket devices for operating radio sets has reached such proportions that the question arises whether this revenue, which has come to the power company without any effort on its part, justifies co-operation in the sale of battery chargers and eliminators. At least in one section of the country the radio trades association feels that the central station should participate in co-operative advertising to stimulate further sales of such devices.

Few power companies know what these devices mean to it in increased revenue. A survey made by a large central station shows that A-battery chargers produce an average revenue of 17 cents per month per radio set and that the average A and B eliminator increases the customer's bill by 40 cents a month. A and B eliminators are only in the development stage today and comparatively few of them are in use, but the investigation shows, on the other hand, that 60 per cent of radio outfits are operated with a storage A battery and a charger.

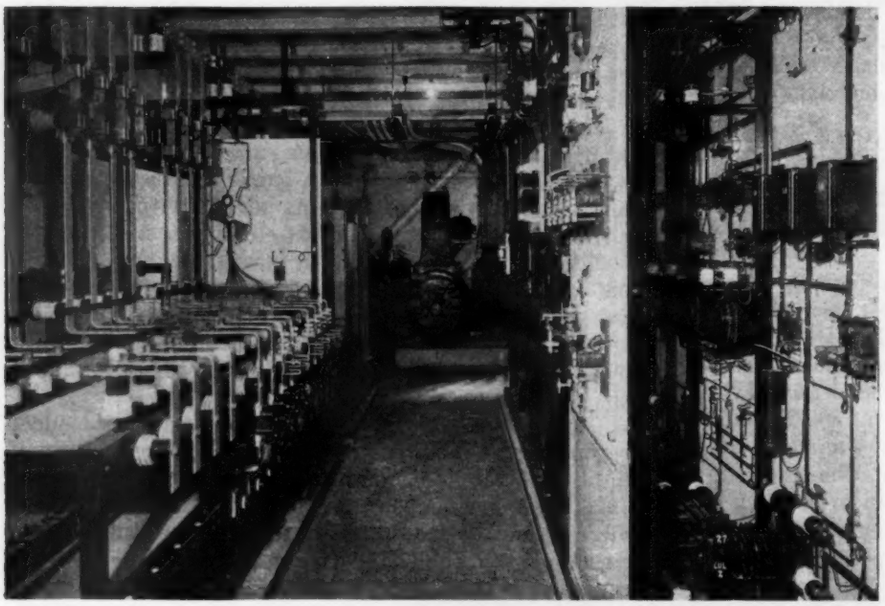
During 1925 this company estimates that its added revenue from radio socket devices and increased use of light on account of radio amounted to $200,000. For 1926 the same company predicts a revenue of $400,000 directly and indirectly as a result of the radio enthusiasm of the public. On this particular system the revenue amounts to an average annual sum of $1 for every electric consumer of all classes on its lines. Radio saturation in this section is probably typical of the country as a whole, and these figures furnish other companies with a rough means of determining what radio means to them in dollars and cents. Whether or not the central-station company should spend a part of this revenue to help stimulate direct sales of socket current-supply sets is a question that will soon confront each individual company. Whatever action is taken, the power company should not overlook the fact that this is about the only class of business which it enjoys that has come to it without any pioneering or direct sales effort on its part.

Most central stations now maintain a crew and equipment for locating interference from power lines. If the service man who calls finds that the trouble is due to run-down batteries, he may with entire propriety suggest that future trouble of this kind can be obviated by the use of any one of the several reliable and satisfactory current-supply devices now on the market. To this extent at least the central station can show good faith with the radio trades bodies and at the same time render the customer a valuable service which will be appreciated.

Full Automatic Mercury-Arc Rectifier Substation Used in Rotterdam, Holland



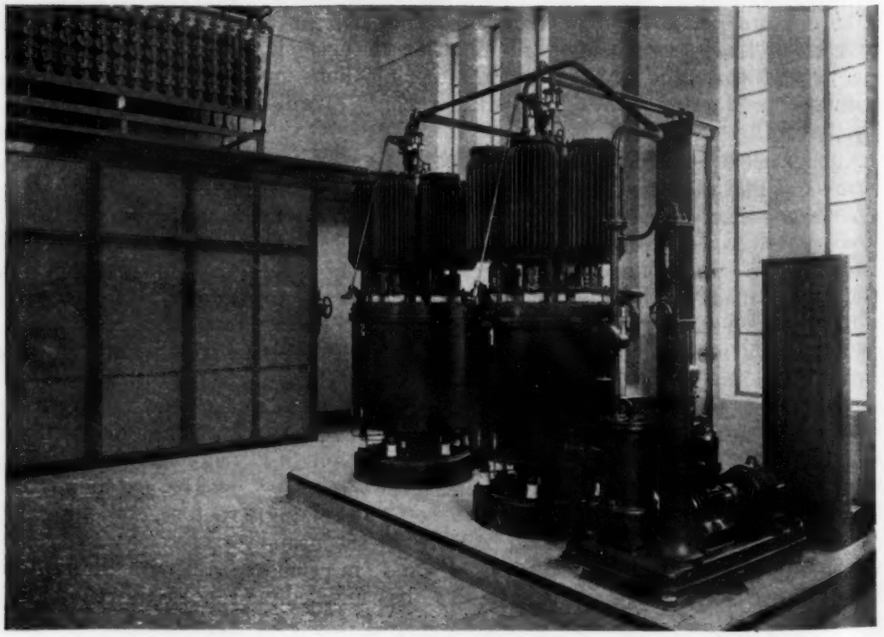
Typical switchboard adapted for metering and automatic control. The main switches are shown in the cubicles on the right.



The rear of the main switchboard, showing automatic control contactors and relays. The outgoing feeders are at the left.

Two mercury-arc rectifiers with radiators at the top. A vacuum pump is shown on the right of the rectifiers.

IN EUROPE the mercury-arc rectifier has been used frequently for railway substations and several industrial substations have been installed. Views are shown of a substation of this type used by the Municipal Electrical Works in Rotterdam. This installation has full automatic control and has given good service.



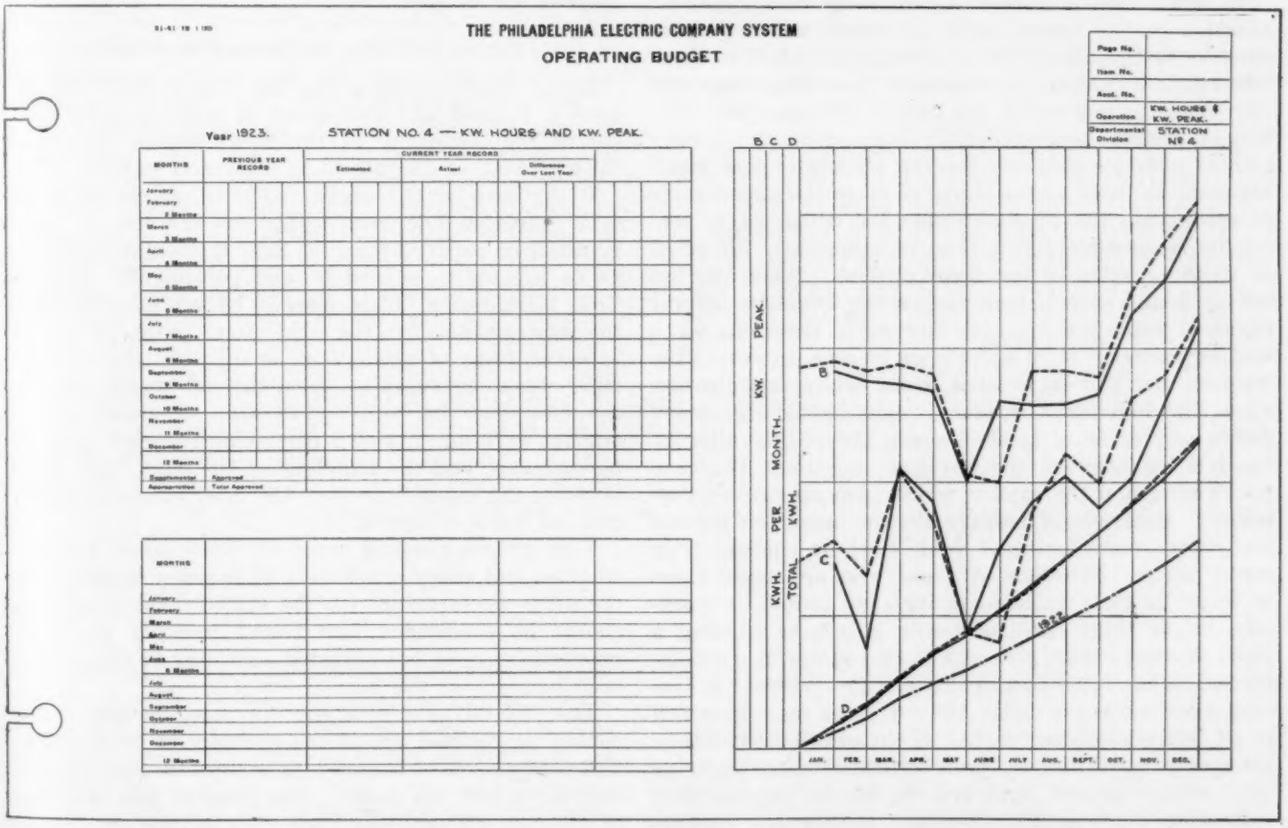
Budgeting Central-Station Operation

Budgets Help Keep a Balance Among Three Dominating Factors, Engineering, Financing and Commercial Activities—Their Scope Outlined—Details of Their Formulation and Operation—Measurement of Success

By H. P. LIVERSIDGE
Vice-President Philadelphia Electric Company

AN INDUSTRIAL organization requires for its successful development an exceedingly fine balance among three dominating factors—financial, engineering and commercial activities. The relative importance of these factors, however, may vary considerably with the type of industry and its particular stage of development.

During the early period of growth the soundness of engineering foresight and skill will have a most important bearing on the future development of the enterprise. This we find to be particularly true of the early history of electric light and power companies, where the problems of engineering took precedence over those of securing capital and business. As we analyze the expansion of electric public utilities, we find that the engineering features kept well abreast of the program and accordingly came to be regarded as matters of course and consequently looked upon as secondary to the pressing problems of satisfactory financing. In those early days capital was secured largely on the basis of faith in the future rather than on a guarantee of attractive return, thus creating difficulties that were of major importance. As we follow these great undertakings, however, it is clear that the industry due to diligence in the development of its properties brought about conditions where the investor was given substantial guarantees and new capital was much more readily attracted due to the stability of earnings. This condition, in the final analysis, has been established to a great extent through the application of sound management methods. A continuance of this program with even greater attention to increasing the standard of management will materially aid in guaranteeing a satisfactory future for electric light and power companies.



FORM FOR MAKING OUTPUT ALLOCATIONS IN AN OPERATING BUDGET SYSTEM FOR THE STATION OPERATING DEPARTMENT

It is hardly necessary to comment on the proved fact that capital requirements for extensions are readily secured when the record of performance tells a plain story to the investor. Extravagant extension to plant or careless production and distribution methods are certain to create unsatisfactory conditions. From the investor's viewpoint, the electric light and power industry is today recognized as sound. It will continue in this position so long as the results justify this confidence.

An analysis of operating records of successful light and power companies shows a uniformly steady im-

provement in economies of generation and distribution, resulting in decreased cost of energy to the consumer regardless of the marked increase in costs of labor, fuel and equipment. There has been exceptional improvement in design and construction of generating and distributing plant, and although further progress is to be expected, it is hardly likely that as radical an improvement along these lines will be made in the immediate future. If, therefore, we expect to maintain the past rate of improvement in production and distribution costs, greater attention must be given to the possibilities that are offered in the field of improved management of our physical operations.

One of the most important factors in guiding operations relating not only to generation but to transmission and distribution is a practical, efficient budget system. It is not to be expected, however, that the mere establishment of a budget system that simply provides for perfunctory tabulation of estimated and actual costs will automatically bring results. On the contrary, such plans in themselves will rarely justify the expense of preparing and tabulating the information.

In order that a budget system may be thoroughly effective in the reduction of operating expense there must be co-ordinated with it an organization of workers who are in a position by reason of their knowledge and experience to accomplish the best results possible. The budget system here described is based on the fundamental principle that any worker, no matter how small his part, can be a useful factor if given the opportunity of estimating the expense items for which he is personally responsible and is then kept regularly informed as to the results he has accomplished. When carried out in detail, such a plan necessarily requires several years of intensive training before it functions as a routine matter. It is surprising to note, however, the interest that can be created in an active organization when the individual workers, their immediate supervisors and division heads become thoroughly alive to the relation between the physical operations they are performing and the capital which such operations represent. Materials of construction or operation become more than mere units of coal, steel or copper; they stand out in the minds of those who are using them in terms of their value in dollars and cents. A workman might think little of losing a bolt or wasting a piece of copper wire, whereas if that material is transformed in his mind to so much money—whether a five-cent piece or a five-dollar bill—it is at once regarded in an entirely different light. If, in addition to all this, his specific operation has been estimated in advance, his task takes on a new light and the results accomplished will mean more to him than the perfunctory completion of a routine job; the incentive for doing the work within or better than the estimated cost becomes a matter of personal pride.

An operating budget should cover the estimated expenses entailed in the performance of every task of each department engaged in the operation and maintenance of the physical property. These expenses should be estimated preferably for a period corresponding to the entire fiscal year, and should cover in detail all expenditures classified according to the accounting system in use, with such further subdivision of accounts as is necessary to promote greatest economy.

Segregation of the estimated expenses should be made into groups corresponding to each of the various stations, their special characteristics or departmental functions. The estimate of costs thus prepared will not only serve as a basis to forecast as accurately as possible the operating expenses of the company but also will provide a means for systematically following up the results obtained by comparison with actual expenditures, with a view to furnishing information for a study of ways and means to secure greater efficiency of operation.

The preparation of the first budget is generally considered as a hopeless task when taken as a whole, but as soon as the first detail make-up is outlined, it is promptly realized that a concrete forecasting of the various expenses can be made for each individual item, and it further develops that only a few uncertain quantities remain to be estimated, which generally requires only the use of good judgment and ordinary common sense instead of speculative guesses.

There are naturally a number of unexpected expenses, unforeseen contingencies, or acts beyond the operator's control, which may occur in the course of operation. These special features will stand out by themselves, the reasons given, and, in the end, enhance the practical value of the budget.

PREPARATION OF THE OPERATING BUDGET

Every detail of the operating budget should be discussed, revised and completed as soon as practicable before the beginning of the fiscal period, and, after the approval, should become a matter of record.

Every man in the organization in charge of a certain operation and responsible for the use of labor, material or supplies must be kept thoroughly informed as to his costs, accurately and periodically itemized. This information, supplemented by an assignment of the performance for the next fiscal period as to the expected rates of production, quantities, cost of materials, fuels or supplies, schedules of wages, etc., as the case may be, will enable each of these men to manage carefully his own particular function, plan the performance and the handling of the work, and finally evaluate the expenditures on the most efficient and economical basis of operation.

This estimate should cover in detail labor, material, supplies and every other item of expense entering into the given performance for the stated fiscal period, and should be subdivided into twelve monthly parts, not necessarily equal, but adjusted according to the seasonal requirements of the service.

The full advantage of the operating budget system cannot be realized unless the estimate of requirements and comparison of actual with estimated costs are carried down into the ranks. The interest and assistance of the men who actually burn the coal, use the supplies and make the repairs are vitally important. The experience of a number of years with an operating budget system has shown that the best way to secure this result is to give to the men in the ranks a hand in the estimate as far as it pertains to their duties, and then hold them responsible to a similar extent for the actual costs.

The first step in the preparation of an operating budget is for the executives of the engineering and commercial departments to estimate carefully the total electrical energy output that will be required during the fiscal year, taking into consideration all factors available that might affect the volume of business of the utility. This estimate must necessarily be predicated on a sound assumption of the trend of the business of

the country as a whole and more particularly as governing the local field or territory served.

By the same process the net addition to the number of customers is determined, as well as the peak demand of the system and the amount of extension to the various elements of the plant to take care of the estimated growth of business.

With this information thoroughly discussed and finally agreed upon, the next step is for the engineering department in charge of operation to allocate the production of the output among the various sources of power, with due regard to the economical features and other characteristics of each source.

From a survey and inspection of the conditions of the various components of the physical property constituting the generating system, a schedule of major repairs or maintenance work is determined for the fiscal period covered by the operating budget, and the output allocation is made, taking this schedule into consideration.

The illustration on page 189, "Station No. 4, Kilowatt-Hour and Kilowatt Peak," is a page taken from an operating budget system illustrating such output allocation. The actual figures have not been included on the budget sheet, but the diagrams indicate by comparison the relative monthly values of the various items included in the accounts. For the year 1923 the estimated monthly output of this station is shown by the solid curve *C*, the cumulative output by the solid curve *D* and the actual outputs corresponding by the dotted curves. The actual output for the preceding year is given by the dot and dash curve *D*. Similar conventions designate the estimated and actual monthly peaks in curves *B*, and they will likewise be employed for estimated and actual operating expenses in the charts to follow.

The estimate of output shown was not merely a projection of past performance, as can be seen by comparing it with the actual output of the preceding year. On the contrary, each monthly value is obtained by careful consideration in detail of the conditions anticipated for that month; allowance being made, in particular, for the overhauling of a generating unit in May and early June, and for the installation of an additional unit about Nov. 1.

Actually, the overhauling extended into early July, and the new unit was in operation early in October; and the effect on the output is shown quite plainly in each case.

The schedule of rates or prices for labor, fuel, materials and supplies is then discussed and revisions are made wherever necessary, or are indicated by reason of the conditions of the market, terms of contracts or trend of costs.

Finally, a bogey is set up for such costs or expenses as may be indicated and which seem possible of attainment with careful and judicious management of the operation involved in each particular case.

Each plant superintendent is then furnished with the necessary information determined by the process outlined above, which enables him to discuss with his subordinates and assign to each pivotal man of his plant organization his share of the performance.

Each one of these men in turn studies the estimated performance assigned for the fiscal year and, after discussion with the group of men under his charge, all the elements of cost and expenses are carefully determined and presented for discussion with the plant superintendent and finally submitted to the executive for approval. By a like process, the operating budget of the substations is prepared.

The transmission and distribution system of property is treated in a similar manner, due consideration being given to additional mileage of overhead lines, underground cables and conduits, transformers and line equipment which it is contemplated to install during the fiscal year.

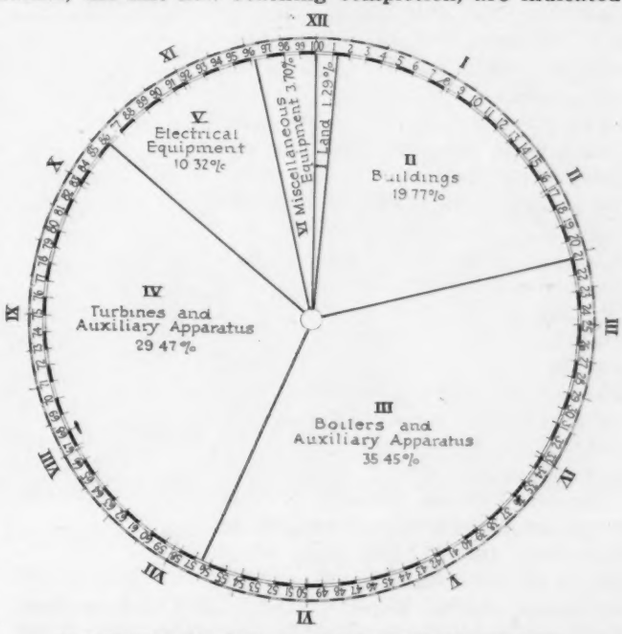
An inspection and survey of the conditions of the system of transmission and distribution supply the necessary information for a schedule of maintenance and repair work and permit the preparation of an estimate of the expenses involved in this work.

The street-lighting system, the testing and maintenance of meters and other utilization items are likewise estimated for operating and maintenance expenses for the fiscal year.

More details of a tried budget system will be given in the next issue of the ELECTRICAL WORLD.

Division of Investment in Tulsa Power Station

THE subdivisions of costs of building the Tulsa steam station of the Oklahoma Power Company, which was started in 1919 and erected in three installments, the last now reaching completion, are indicated in the accompanying diagram. A description of the plant, which has 30,000 kw. in generator equipment, was given in the article entitled "Keeping a Modern Station Up to Date," by James F. Brown, chief engineer, published in the Oct. 24, 1925, issue of ELECTRICAL WORLD.



SUBDIVISION OF COST OF BUILDING TULSA STATION

General construction expenditures, such as engineering and supervision, construction office expenditures, transportation of workmen, construction storeroom expense, are distributed pro rata among the six subdivisions. (I) Land includes first cost of land, roads, beautifying grounds, protection of river bank. (II) Buildings include substructure and superstructure, machine foundations, pump houses, intake house, discharge well, concrete work at spray ponds, coal crane runway, structural steel. (III) Boilers and auxiliary apparatus include boilers, furnaces, economizers, draft fans, flues and stacks, fuel-handling and storage equipment, oil burners, pumps, stoker, evaporator, water-treating plant, all station piping. (IV) Turbines and auxiliary apparatus include turbines, generators, exciters, condensers and auxiliaries, traveling and stationary screens, spray ponds. (V) Electrical equipment includes switchboards, switches, meters, conduit wires and cables, battery. (VI) Miscellaneous equipment includes cottages for employees, machine tools, turbine room crane, automobiles and trucks for operation (but not construction).

Plant of Manila Electric Company, P. I.

Installation of New Unit Provides Occasion for the General Rehabilitation of Plant, Originally Designed Only for Energy Supply to Street Railway—Improvements Made in Entire Plant from Coal Handling to Distribution

By G. G. HOLLINS and M. M. SAMUELS
The J. G. White Engineering Corporation

THE plant of the Manila Electric Company is located on the Isla Provisor, in the Pasig River, approximately two miles from Manila Bay. Since 1904, when the initial installation was made, the plant has been enlarged and improved seven times. The latest improvement was the installation of a 12,500-kw. Allis-Chalmers turbo-generator. Before the installation of this unit the plant had grown by the simple accretion of unrelated units, with the result that the generating station and distributing system was a hodge-podge of semi-modern, semi-obsolete and definitely obsolete equipment and practice. The addition of the new unit furnished proper occasion for a complete rehabilitation of the plant and system.

The present condition of the plant is such as to compare favorably with others of its size in the United States. The power plant buildings are steel frame structures on a concrete mat resting on piles. The boiler room is covered with corrugated iron with the lower portion open for ventilation. The main turbine room has reinforced concrete walls and roof and the 1924 extension also has reinforced concrete roof and walls, except on the sides to be later extended, where there are temporary corrugated iron walls.

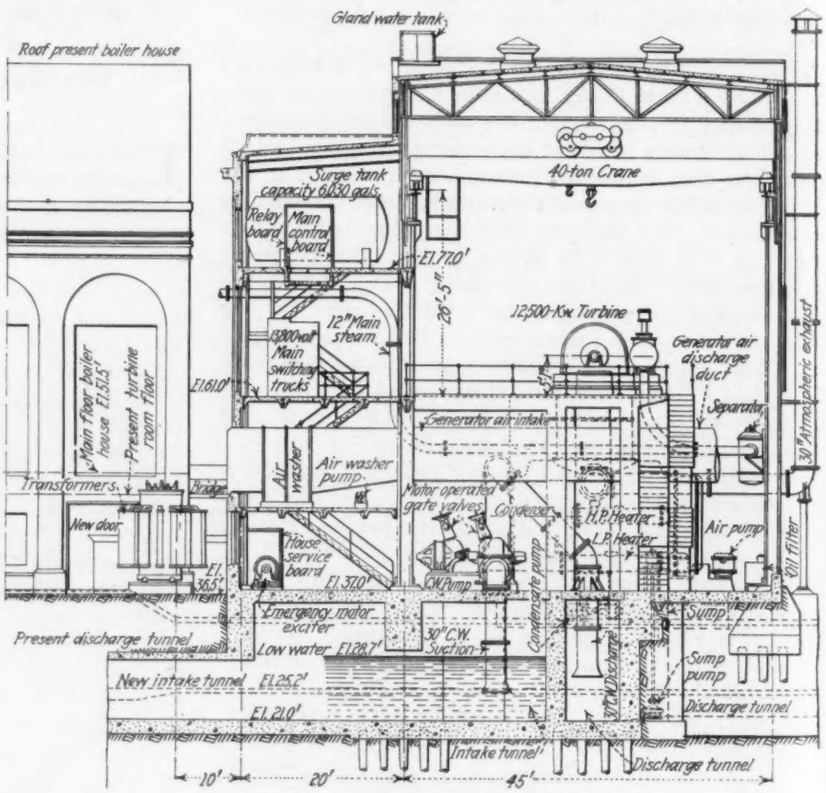
There are twelve 508-hp. B. & W. boilers set in batteries of two, all rebuilt from the 372-hp. units which were in the old installation. New tubes were added and the boilers raised so that they are now capable of operation at 250 per cent of rating. They operate at 200 lb. pressure and 100 deg. F. superheat.

Four boilers are equipped with Taylor six-retort underfeed stokers 10 ft. 10 in. deep, each having a projected area of 117.3 sq.ft. The remaining eight boilers are provided with Coxe chain grate stokers, each having an effective area of 119¾ sq.ft. For the type of coals used at Manila the chain grate stokers are better adapted and give higher efficiency. The chain grate stokers were installed particularly to burn the Chinese semi-anthracite and the native coals when the latter are produced commercially. The coal deposits in the Philippines have not been developed and so far the coal used has been imported. Coal is brought to Manila from China, Japan, Australia, Borneo and Manchuria, that used in the plant coming from China.

There are six forced draft fans, each driven by a Terry steam turbine and having a capacity of 60,000 c.f.m. at 6-in. static pressure. A group of three fans furnishes forced draft through a common air duct to six boilers. The capacity of the fans is sufficient for two fans to supply air for six boilers at 250 per cent of rating, the third fan serving as a spare.

The original hand-fired installation had a steel chimney, but when the boilers were increased in capacity and it was desired to operate them at high rating, a much larger and higher chimney was required. On account of Manila being subject to earthquake shocks it was decided that it was inadvisable to build a high chimney and that induced draft fans would be better for the conditions. There are six induced draft fans arranged in groups of three at each end of the power house. Each group of fans serves six boilers and the capacity of the fans is such that two of the three fans will carry the corresponding boilers at their maximum rating. Four of the fans are driven by steam turbines and two are direct connected to motors. Each fan has a short steel stack for the discharge of the flue gases.

The old boiler-feed pumps are direct acting, but there have been installed recently two Jeansville centrifugal pumps driven by Terry turbines, capacity of each 300 g.p.m. at 578-ft. head, and one Jeansville centrifugal pump direct connected to a motor, capacity 500 g.p.m. at 600-ft. head.



CROSS-SECTION OF POWER HOUSE EXTENSION

The original coal-handling equipment consisted of a pivot gantry crane having a radius of 100 ft. This crane overhung the river to unload coal barges and stored the coal in a circular pile. The unloading capacity was increased by a Brownhoist twenty-ton, eight-wheel locomotive crane with 50-ft. boom and clamshell bucket. For distributing the coal in storage and reclaiming it, a drag scraper was installed.

In the new coal-handling system the coal is delivered from the storage by the scraper conveyor or locomotive crane to a track hopper, from which it is carried by an apron conveyor to the crushers. From the crushers the coal is elevated by means of an inclined flight conveyor to a 200-ton bunker adjoining the boiler house near the center of the building and above the stoker hoppers. The bunker is divided into two equal compartments for different coal for the underfeed and the chain grate stokers. The flight conveyor was chosen because the type of labor available does not properly maintain a bucket elevator, as the parts are more or less inaccessible and out of sight for easy inspection and a belt conveyor is not suitable in the hot, moist climate.

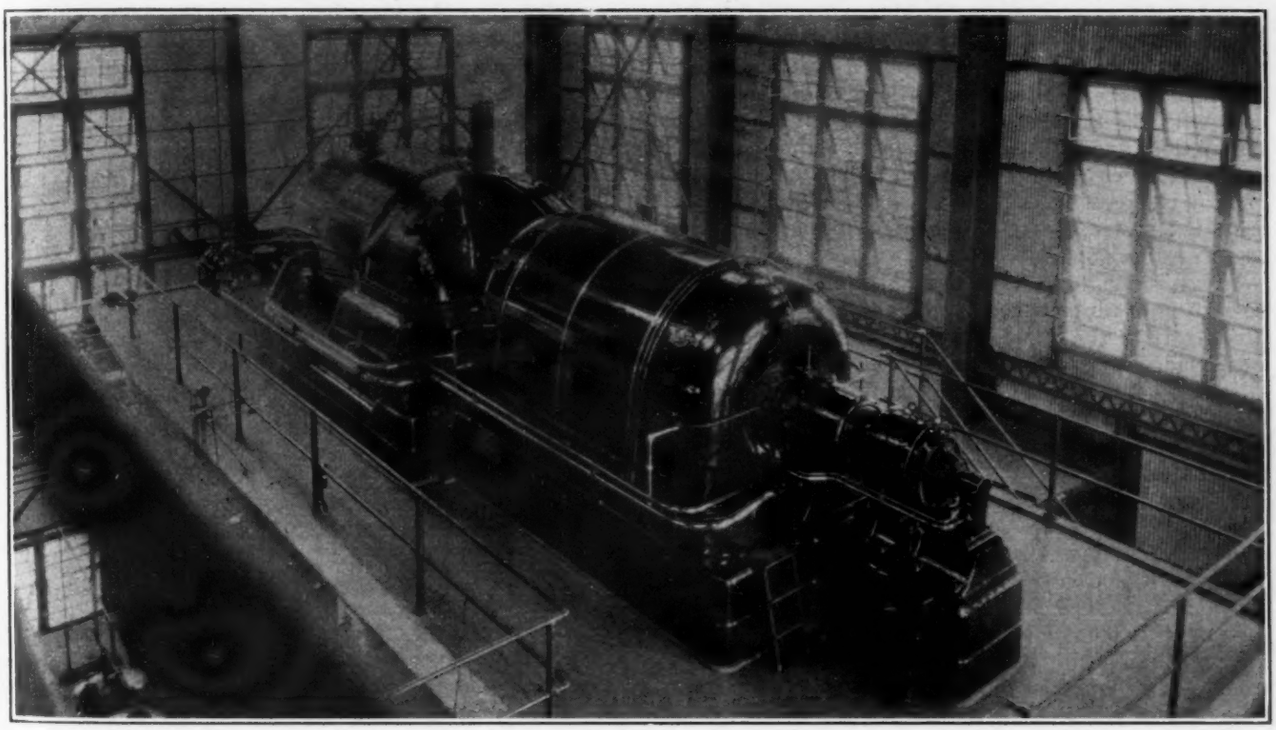
A system of narrow-gage industrial side-dump cars with two and one-half ton storage battery locomotives was installed to deliver the coal from the bunkers. The industrial track is supported on a structural frame above the stoker hoppers and extends under the coal bunker. The cars are filled from gates in the bottom of the bunker and after passing over recording track scales are dumped into the stoker hoppers.

The ashes are removed with a duplicate locomotive and tip cars which receive the ashes from the hoppers under the boilers.

The main turbine room contains one 2,000-kw., two 2,500-kw. and two 5,000-kw. turbo-generators. These units are designed to operate with steam at 180 lb. pressure and 100 deg. F. superheat. They are all fitted with surface condensers.

One of the 5,000-kw. units was installed in 1919, and the other in 1921. These two units are identical except for the condensers and circulating pumps. The 1919 unit has a 10,000-sq.ft. condenser with 10,500 g.p.m. of circulating water, and the 1921 unit has a 12,000-sq.ft. condenser with 13,500 g.p.m. of circulating water. The larger condenser was found desirable on account of the high temperature of the circulating water, which averages 84 deg. F. for the year and the minimum temperature is 76 deg. F. The operating records show 0.2 in. better vacuum for the larger condenser. Both condensers and their auxiliaries are Westinghouse. The auxiliaries are motor driven and the air pumps are LeBlanc. The generator air is cleaned with spray washers.

The turbo-generator installed in the 1924 extension is a 12,500-kw. Allis-Chalmers unit designed for operation with steam at 300 lb. pressure and 625 deg. F. total temperature, but as new boilers were not installed, the turbine was adjusted for operation at the present steam pressure of 180 lb. and 100 deg. F. superheat. When new boilers are added to the plant, the turbine, by the addition of high-pressure blading, will be suitable for operation on the higher pressure. The turbine is arranged for stage bleeding and two stage heaters are installed. The condensate is delivered by the condensate pumps, which are in duplicate, through the stage heaters to the boiler-feed pumps. A large surge tank is provided on the high side of the stage heaters to equalize the flow of condensate.



ALLIS-CHALMERS 13,800-VOLT, THREE-PHASE, 12,500-KW. TURBO-GENERATOR INSTALLED IN LATEST POWER HOUSE EXTENSION

The condenser is a 30,000-sq.ft. C. H. Wheeler standard two-pass type with divided water box. There are two motor-driven circulating pumps, each having a capacity of 18,000 g.p.m. The circulating piping is provided with motor-operated valves so that the water may be shut off one side of the condenser for cleaning and both circulating pumps operated on the other half.

The two condensate pumps are motor driven and each has a capacity of 340,000 lb. per hour. The air pumps are steam ejector type and there are two sets, each

complete with inter and after condensers. One set is sufficient with normal air leakage.

The original circulating intake was not large enough for the 1924 unit and a new intake was constructed with circulating water inlet and discharge tunnels. The circulating water is taken in on one side of the island and discharged on the other side. The intake is constructed of sufficient size for four 12,500-kw. units and will ultimately contain four traveling screens. Only one screen is now installed and the other screen chambers are closed with stop logs. The present circulating water tunnels are for two 12,500-kw. units.

The original installation at Manila was primarily intended for trolley load, and the old generators were 380 volt, three phase, 60 cycle, one such generator, 2,000 kw., still being in service. Later on, during that period of electrical development when two-phase transmission and distribution was standard practice, it became necessary to take care of a considerable power and lighting load, and two 5,000-kw. and two 2,500-kw., 3,400-volt, two-phase units were added, one at a time.

When it became necessary by load conditions to proceed with the installation of a rather large unit, much larger than any of the existing units, a thorough study of the whole electrical system had to be undertaken, and radical changes in the switching as well as the distribution system became necessary, giving due regard to future development.

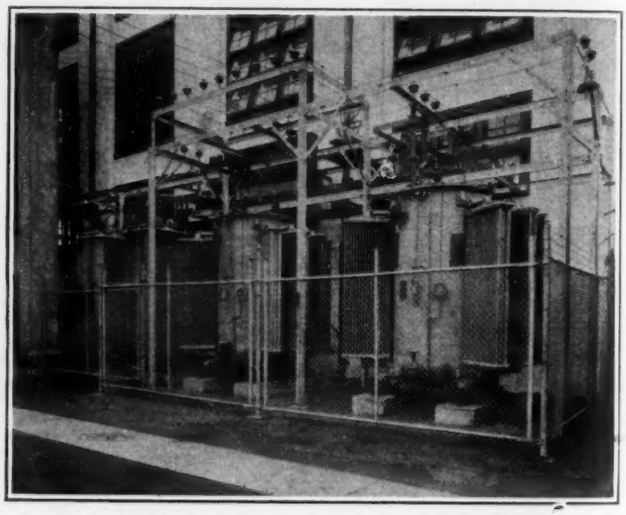
It was found, first of all, that the distribution system, consisting of a number of 3,400-volt, two-phase circuits, directly from the power house, was inadequate, and it was decided to establish a 13,200-volt, three-phase transmission system, and a number of substations at suitable load centers, stepping down in each case to the existing 3,400-volt, two-phase, by means of banks of Scott-connected transformers.

The old switching equipment, with the possible exception of two or three oil circuit breakers, was quite obsolete, and it was out of the question to extend it. A new switchboard with all modern improvements was provided, arranged so that it can be extended to take care of a 50,000-kw. plant. The old switchboard was greatly simplified by removing a great many of the 3,400-volt circuits, leaving only a sufficient number to take care of the load in the immediate vicinity of the power house.

The new control switchboard is made up of steel panels, principally for the reason that they are not subject to breakage in transportation over the long distance and in the several transfers from rail to boat, as slate would have been. It is no doubt one of the very first all-steel control boards, and the fact that now, only a short time after its installation, a great many steel boards are being installed in large power houses in the United States proves that it was a step in the right direction.

Two sets of 13,200-volt buses were provided in the new installation, inclosed in steel compartments which were made in units, one unit per circuit, completely assembled in the factory and shipped assembled, ready to install. There is one oil circuit breaker per circuit as well as two sets of triple pole gang-operated disconnecting switches for transferring from one bus to the other. The oil circuit breaker of each circuit, with its two sets of disconnecting switches, current and potention transformers and other auxiliaries, is mounted on a removable truck, which was likewise completely assembled at the factory and shipped assembled, ready to slide in place. The rupturing capacity of the oil circuit breakers was determined on the basis of a total of four 12,500-kw. units, and Westinghouse breakers, type E-17, were chosen as the most suitable for the purpose, having a guaranteed rupturing capacity of 11,000 amp. at 13,800 volts.

For the purpose of connecting the old 3,400-volt, two-phase buses to the new 13,200-volt, three-phase buses there are provided two banks of Scott transformers, each bank being 6,250 kva., with the idea in mind that eventually the smaller units and the complete 3,400-volt system will be abandoned in the power house and each of the two 5,000 kw. units, which are quite up to date, could then be connected, each through one of these two banks of transformers, to the 13,200-volt buses, the switching then to be done on the 13,200-volt side. These transformers are arranged outdoors with the necessary bus work above them, and a wire mesh inclosure is provided around the transformers. The 3,400-volt con-



SCOTT TRANSFORMERS TYING THE OLD 3,400-VOLT, TWO-PHASE SYSTEM TO NEW 13,800-VOLT, THREE-PHASE INSTALLATION

nections to the old building consist of copper bars, and the 13,200-volt connections are carried in bare copper wire to the outside wall of the new building and thence in insulated cable to the respective truck compartments.

Owing to the fact that 3,400-volt, two-phase was not a very suitable form of energy supply for auxiliaries, 2,300-volt, three-phase was first considered, but had to be abandoned due to the inadvisability of adding another voltage to the already existing multiplicity of voltages, and 440-volt, three-phase was chosen for the larger auxiliaries. An auxiliary switchboard with triple pole carbon breakers serves as the main supply for all auxiliaries. For these motors which are located within sight of the switchboard hand-operated breakers are provided, and the motors are thrown on directly from the switchboard. For those motors that are located remote from the switchboard solenoid-operated breakers are provided on the board, and the respective control switches and indicating lamps are located near the motor. The circulating pumps are driven by slip-ring motors and are started from the switchboard, the circuit breakers and controllers being mounted directly on the board and the respective grids arranged behind the board.

The energy is carried from the power house in four three-phase, 13,200-volt circuits to Pandacan substation, located in the principal load center and in which are installed three banks of Scott-connected transformers,

each of 2,000 kva., stepping down to the distribution voltage of 3,400 volts, two phase. Pandacan likewise serves as a distribution point for the 13,200-volt system, supplying energy at this voltage to Fort McKinley and Pasay substations in one direction and to Tondo and Caloocan substations in the other directions.

Each substation has two sets of 13,200-volt buses, and each circuit has two sets of gang-operated disconnecting switches and either a hand-operated oil circuit breaker, as is the case in the larger stations, or an S. & C. fuse, as is the case in the smaller stations, all arranged outdoors, on a steel structure built up of Bates poles. The 13,200-volt gang-operated disconnecting switches are mounted in vertical position and are of very simple design, consisting of three standard outdoor disconnecting switches having a shaft on the hinge center line with a standard insulator between the phases, forming part of the shaft. Each line is equipped with autovalve lightning arresters. The low-tension equipment in each substation, including railway equipment, is arranged in a building of unique architecture, presenting a much better appearance than any of the substations in the Eastern or Middle Western United States and comparing favorably with the best looking substations in the West, where Spanish influence is shown in station architecture.

Methods of Impregnating Cables

New Developments in the Impregnation of High-Voltage Cable Outlined—Advantages and Disadvantages of Practices Used—Newest Scheme Offers Great Possibilities

By HENRY W. FISHER

Technical Director of Engineering and Manager Lead Cable Works, Standard Underground Cable Company

DUE to the general interest in cables that has been evidenced in recent years, and especially in extra-high-voltage cables, it is thought that a short general outline of some of the newer developments in methods of impregnating paper-insulated high-voltage cables would be of interest, especially a new construction that makes possible an even greater degree of perfection.

The Usual Method.—The method that has normally been used for many years consists in general in putting the conductor (or conductors), which has been insulated with paper tape but not lead covered, into a large tank. Fig. 1 shows a section of a representative single-conductor cable of the usual form. The cable is heated for a period of time, the air is evacuated and the cable is heated under vacuum for an additional period of time. Then, when the cable is dry, a valve leading to a tank of hot compound is opened, and this compound is therefore drawn into the kettle and completely covers the cable and penetrates the insulation, no air being admitted during this process.

There are some practical difficulties, however. In the first place, no vacuum is perfect, and commercial vacuums in large kettles are more imperfect than those obtained in the laboratory. There is always therefore a slight quantity of residual air and moisture. The residual air and moisture that are actually in the cable insulation during the vacuum treatment tend to be driven toward the inner layers of insulation when the compound is admitted. Furthermore, after the compound has once covered the cable, the only methods of controlling the process are to change temperature, pressure or time. This method of impregnation, however, has been capable of producing in cables normally used up to now a high standard of finished product. Nevertheless the thicker the wall of the insulation the more difficult does perfection become.

It is desired to emphasize that the characteristic of this method of impregnation is that the wall of insulation is exposed on one surface only, the other surface of the insulation being against one of the electrodes, in this case the conductor.

Hollow-Core Impregnation.—To overcome the difficulties outlined, the writer and one of his associates developed a new method five or six years ago. According to this method, which is particularly applicable to single-conductor cables with thick insulation, the conductor is of special construction, one form being made by surrounding a spiral steel spring with a copper strand, using enough copper to give the total desired copper cross-section. The conductor, composed of copper wires laid spirally around the central steel spring, is then insulated as a whole as shown in Fig. 2. This construction leaves an opening or channel, which we shall call the "hollow core," through the center of the conductor.

Several methods have been developed for impregnating the cable. As an example, the reel of non-leaded paper-insulated hollow-core cable can be placed in a kettle and dried under heat and vacuum. The two ends of the cable are connected by special couplings to a pipe leading out of the kettle and connected to a tank of hot compound. After the cable has been dried under vacuum and while vacuum is maintained on the outside of the cable in the kettle, compound is admitted to the central core, under either atmospheric pressure or higher pressure if desired. The compound will very quickly fill the entire central channel through the conductor—namely, the hollow core. It will then flow in a radial direction outward through the insulation, driving ahead of it the residual air and moisture. After a short time the compound will reach the outer surface of the cable insulation and in the hollow-core impregnation the flow of compound through the insulation may be maintained as long as desired in order completely to drive out the last traces of air and moisture. This method, therefore, gives a new and important control over the process of impregnation.

Another method of accomplishing the same result is to reverse the flow of compound, keeping the cable

under compound and applying vacuum to the hollow core, though the two methods are very closely the same in the last analysis.

In all the methods described the cable is allowed to cool in the compound to a temperature so low that it can be lifted out without danger of drainage of compound from the cable and is afterward lead-covered.

Foreign Method.—A further modification has been proposed in Europe[1] for cases when it is desired to use

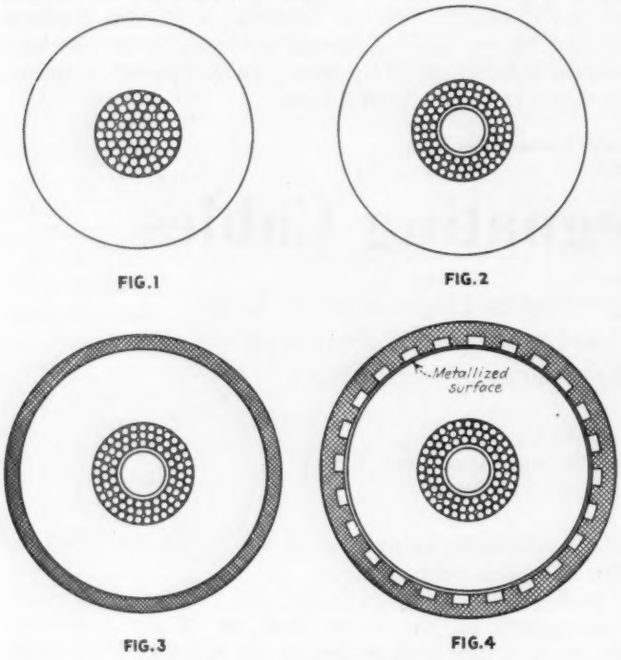


FIG. 1 FIG. 2

FIG. 3 FIG. 4

DIAGRAMS OF CABLE IMPREGNATION SCHEMES

Fig. 1—No lead sheath. Only outer surface of insulation available.
Fig. 2—No lead sheath. Both inner and outer surfaces of insulation available.
Fig. 3—Lead covered. Only inner surface of insulation available.
Fig. 4—Lead covered. Both inner and outer surfaces of insulation available.

a very thin compound for the impregnating fluid. After a cable is impregnated by any method—if thin oil is used, for instance—it is difficult to accomplish the leading of the cable without considerable draining, which would greatly injure the electrical qualities of the insulation. The method used in Europe has also involved the hollow-core construction, and the method of impregnation as described in the foreign press is to dry the lead-covered cable with hot air through the hollow core and then to evacuate the air and moisture from the cable through the same channel (see Fig. 3). After the cable is dried, the oil is admitted under vacuum through the hollow core, and the cable is impregnated from the conductor outward toward the sheath.

Inasmuch as the lead sheath is already on the cable, the difficulty of lifting the cable out of the compound is avoided, but this procedure loses the thoroughness of hollow-core impregnation done before lead covering the cable. Although this method is really a variant of hollow-core impregnation and is physically different from the usual method described herein, it suffers from some of the same disadvantages as does the customary method. The essential is that only one surface of the insulation is accessible to the compound and that the other surface is not available, but is pressed against an electrode. In the old method of impregnation the free surface was the outer surface and the electrode was the central conductor. In the method just described the free surface is the central surface, which can be reached by compound through the hollow core, and the outer surface, which is against the lead sheath, is the surface that is inaccessible and against an electrode. (Compare Fig. 1 and Fig. 3.) The whole difficulty with residual air and moisture therefore is still present to at least as high a degree as in the usual method of impregnation, and it is impossible to cause a flushing flow of compound as in the case of the hollow-core non-leaded impregnation. The fact that there has been some difficulty in complete impregnation is evidenced by the statement of a manufacturer, who used this process, that he has had to use paper of lower dielectric strength, progressively proceeding from the inside to the outside.

The New Method.—A method proposed some years ago by the writer is now being developed, which seems to avoid all of these difficulties and to combine their several advantages. The cross-section of such a cable is shown in Fig. 4. The main points to note are that the cable is a hollow-core cable, and in addition that there are oil channels between the insulation and the lead sheath, caused by ridges projecting inward from the lead sheath. By this construction the use of a fluid oil is quite possible for the impregnation of a cable that has already been lead covered, and yet a degree of impregnation is maintained as great as that obtainable by the hollow-core impregnation of a non-leaded cable; the impregnation is so effective with this construction that it is possible to use paper of high dielectric strength throughout.

The actual method of impregnation is easily explained. The cable is dried under heat and vacuum through the hollow core, and then compound is admitted through the hollow core. In this case, however, vacuum is maintained in the channels between the outer insulation and the lead sheath. The slight quantity of residual air and moisture is therefore drawn out through these channels instead of being entrapped in the insulation. Furthermore, the actual radial flow of compound or oil can be maintained by this construction in a lead-covered cable, exactly as can be done with the hollow-core impregnation of a non-leaded cable, and yet it is possible to use it with the most fluid oil desired, as the cable is already lead covered before impregnation.

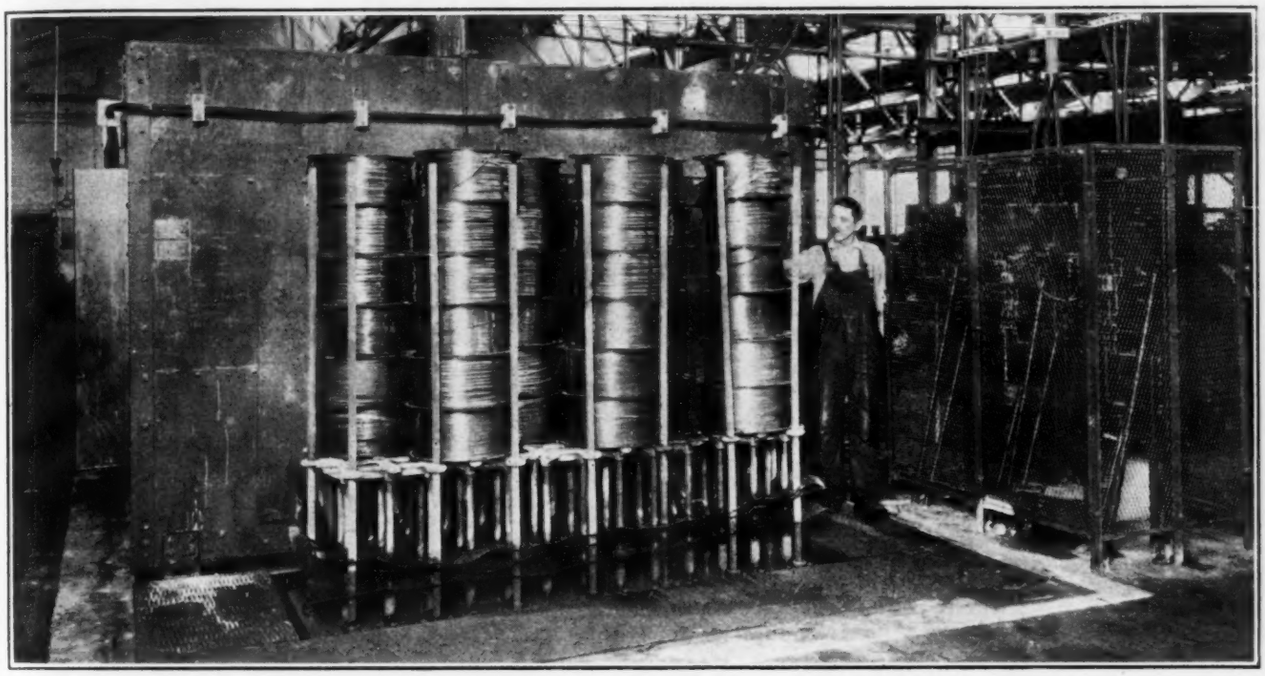
There would, of course, be a concentration of stress against the ridges of the fluted lead construction except that the cable core is surrounded by perforated metallized paper or copper foil wrapped in an open spiral; this cable thus involves the use of single-conductor Type H construction. A glance at Fig. 4 might suggest the thought that the oil channels between the insulation and the lead sheath might be inadequate to maintain a flow of oil. No difficulty has been experienced from this cause in our preliminary work up to date, and it should be pointed out that this is something that is entirely within control, as the oil channels can be made practically as large as needed; even in Fig. 4 the total cross-section of the small oil channels is several times the cross-section of the hollow core.

In conclusion, I might emphasize that the cable of Fig. 4, in addition to the advantages of its Type H construction, accomplishes the same improvement in impregnation and maintenance in service over the cable of Fig. 3 that the hollow-core impregnation of Fig. 2 accomplishes over the ordinary method shown in Fig. 1.

[1] L'Elettrotecnica, 1925, p. 18.

Status of Industrial Electric Heating

Rapid Progress in Applications to Varied Industries — Increased Production and Better Quality Output Attained in Numerous Installations — Central Stations Beginning to Appreciate Load-Building Possibilities



BRIGHT ANNEALING COPPER WIRE, GENERAL ELECTRIC COMPANY

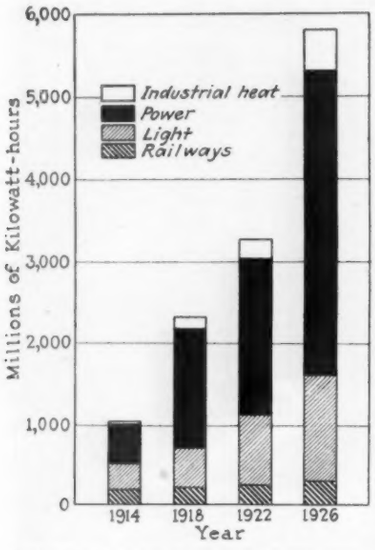
WITHIN the short space of ten years industrial electric heating has grown from an insignificant item among central-station loads to a development of commanding importance. It is perilous for a central-station manager to overlook or neglect the possibilities of this class of business, for surveys indicate that in representative territories electric heating service is increasing at a faster rate than are sales of electricity for power, lighting, transportation or total purposes. More than 1,000,000 kw. of electric-heating apparatus was in service on central-station lines at the beginning of 1925, with about 250,000 kw. more supplied from other sources, and that year's business in this field has probably added at least 20 per cent to the country's total, bringing the annual revenue from the sale of electricity to such installations to the vicinity of fifty million dollars.

It is of small consequence that the present total revenue from industrial electric heating is only 3 or 4 per cent of the total central-station income. The advantages of the heating load multiply its value. Increased utilization of the central-station investment is one of its chief rewards. The present industrial heating load amounts to about two billion kilowatt-hours per year against twenty-five billion kilowatt-hours potential load, according to estimates given out at the 1925 cooperative courses in electric heating under the auspices of the N. E. L. A. and leading manufacturers. The importance of this branch of service is not a matter of ratios to other utility business; it lies primarily in the vast benefits to the user realized and potentially available in properly engineered installations and in the long-hour use of plant to supply a demand of generally highly favorable electrical characteristics.

An example of the accelerated growth of electric heating energy sales in a group of nine prominent central stations of the East and Middle West is shown in the graph on page 198. At the outbreak of the World War their combined sales totaled 1,030 million kilowatt-hours per year, the heating load taking but thirty million and representing only a trifling proportion of either the railway, lighting or power load. An enormous impetus to electric-heating development as well as to power sales in general was given by the war, and at the close of 1918 these nine companies were selling electric heat to the tune of 150 million kilowatt-hours per year. Further gains were realized in 1922, and it is estimated that in 1926 the heating loads of these companies combined will be about 500 million kilowatt-hours, or practically equal to the entire lighting sales of the group in 1918. Already the business is of far greater importance to these central stations than their volume of energy sales to electric railways. This swift upward trend of electrical service in a field of momentous possibilities is a challenge to the enterprise of the modern central-station manager which cannot safely be ignored.

Before citing various examples of recent progress in this field, a few words should be said about engineering analysis. Without a thorough investigation of the fitness of electricity to compete with fuel heating in virtually every industrial application, costly mistakes

may be made that will hamper progress and result in waste. All methods of heating have their limitations, and overenthusiasm for any particular method is dangerous. At present the most active competition is evident between electrical and fuel heating, and a long list of factors which space will not permit printing at this time determines whether or not to install this or that method. It is most gratifying, however, to observe a decided trend in industry toward making over-all analyses of the merits of the various competitive methods in dealing with individual problems. Every heating problem should be attacked from the production and not from the equipment standpoint—that is, the heating equipment should be selected to suit the needs of the job rather than attempting to fit the work to the equipment.



ACCELERATING IMPORTANCE OF THE ELECTRIC HEATING LOAD IN NINE CENTRAL STATIONS

The heating field is now so great that only a few of its trends can be referred to in a single article. Certain common advantages of electricity, however, are manifest, and among the more important of these are accurate heat control, duplication of production cycles with greatly decreased spoilage of material and diminished "seconds," improvement of quality of product, reduction in extent of operations, and increased comfort to employees.

Air Heating

An interesting application of off-peak electric heat to processing has recently been made at the plant of the Seamless Container Company, Hartford, Conn. Here milk bottles and similar products are manufactured out of paper pulp, which when heated under pressure gains mechanical strength and can more readily be molded into any desired shape. Formerly this heating was by gas at a cost of about $220 per month for fuel, but the tubes burned out so rapidly that production was much hampered. The company reports that this frequently occurred every ten days, and two days was required to make repairs costing from $50 to $100. Gas was 90 cents per thousand cubic feet. The problem was taken up by the American Metallurgical Corporation, Boston, and an electrically heated air tank was installed. The air is heated to 750 deg. F. at 70 lb. pressure and is thence distributed to the molding machines. Heating the air under pressure increases the productive capacity, and a maximum of only 30 kw. is required. About 95 kw.-hr. per day is utilized and the cost of energy runs from $40 to $50 per month. The tank is 22 in. in diameter and 5 ft. long, with about 4 in. of heat insulation. It is normally cut off at 4:30 p.m.; the interior air temperature drops to about 300 deg. during the night, and ten minutes, run before 7 a.m. suffices to raise this to full heat. The tank is provided with Brown automatic temperature control and normally consumes energy only about one-third of the working day, the current being cut in and out as the temperature falls and rises. A Sepco automatic safety cut-out is also provided. This installation cost about $2,500, and in about a year's operation the repair expense has been negligible. At this plant two-phase, 220-volt, four-wire service is available, and although the application is in a degree special, its field is not confined to the operation instanced.

Annealing

Noteworthy progress has been made of late in the electric annealing of aluminum, brass, copper, glass, iron and steel.

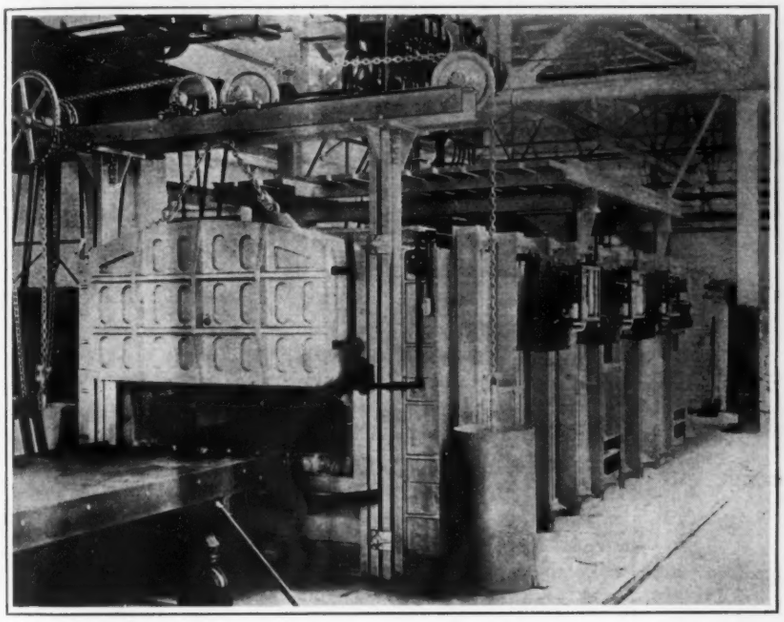
Aluminum.—Past practice was commonly to anneal a large stack of cold-rolled sheet aluminum in a furnace at 370 deg. C. for twenty-four hours, but uniformity was difficult to obtain, the inner and lower sheets often being hard, notwithstanding the effort to obtain saturation by protracted heat application. By reducing the size of the charge, using higher temperatures and in some installations continuous type furnaces, better results have been reached. Thorough annealing has been secured by short applications in the 550 to 500 deg. range. Experience has shown that medium weight (No. 14 gage) sheet aluminum may be softened in ten minutes at these temperatures from 15 to 5 scleroscopic scale. In furnaces of the box type, with fairly large charges, the time of heating may range from two to five hours and the temperature range from 350 to 500 deg. C. The electric furnace facilitates the use of the continuous method of annealing, and sheets of No. 19 gage have been satisfactorily annealed at 400 deg. C. in as short a period as ten minutes when passed through the furnace singly. On occasion, several sheets may be stacked. With the continuous method the small amount of metal in the furnace at any one time facilitates uniform heat absorption, and the absence of impurities due to combustion products is of great value with the electric furnace. The accuracy of temperature control automatically maintained is as important and useful in annealing aluminum as in other metallurgical applications of the electric furnace. So successful has been the continuous annealing of aluminum sheets that the electric furnace is also coming into favor for annealing castings of this material.

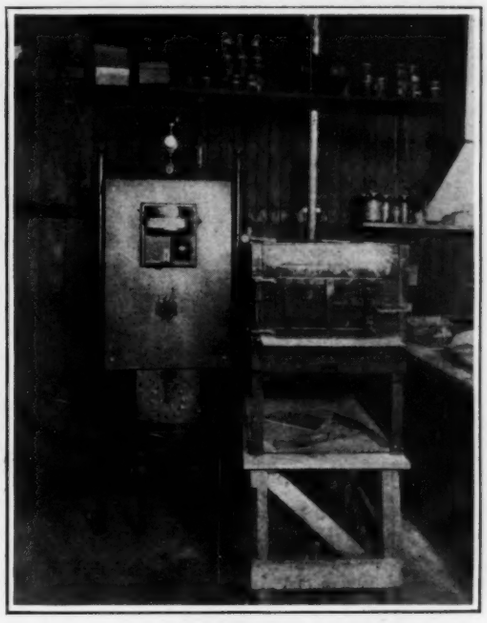
Brass.—Electric furnace annealing of brass tubing of light weight is making rapid progress and the indications are that it will ultimately replace combustion furnace annealing, especially in plants drawing seamless tubing in small sizes and thin gages. Wood-fired muffle annealing furnaces have been used in this work for a century or more, but while the B.t.u. cost of wood vs. electricity favors the former in many if not most cases, the superior temperature control of the electric furnace and the improvement in working conditions associated with it have justified its installation. In brass tube annealing the material is usually brought to a temperature of between 1,000 and 1,350 deg. F. This releases the strains in the metal set up in the process of drawing or machining, which causes brittleness from the grain size becoming too small. If the annealing temperature is too low, the grain size will be left too small, with resulting brittleness, and conversely, if the temperature is too high, the grain size will be exces-

sive with metallic disintegration and poor metal yield.

At the Chase Metal Works, Waterbury, Conn., wood-fired furnace annealing of brass was replaced by electricity, and the capacity of the furnace was increased fourfold. The working conditions were improved and the handling of ashes was eliminated. At the co-operative General Electric school this year it was stated that the investment paid for itself within a comparatively short time.

An interesting installation for brass annealing is that of the French Manufacturing Company, also at Waterbury. Here an electric furnace with a heating chamber 16 ft. long, 54 in. wide and 18 in. high to the spring line of the arch, insulated with 16 in. of insulite brick, is equipped with Westinghouse heating coils, contactor panel and Leeds & Northrup recording pyrometer control. The temperature of the furnace chamber is maintained at 1,200 to 1,350 deg. F. A recording pyrometer is also provided to indicate and register the temperature in the center of the charge, and in practice the charge is withdrawn when this reaches 1,000 deg. Writing of this installation in the Westinghouse publication, *Electric Heat*, President F. W. French states that the energy consumption averages 110 kw.-hr. per ton of brass annealed. With power at 2.33 cents per kilowatt-hour and wood at $8 per cord, the cost of power per ton of brass annealed is only 7.5 per cent higher than that of wood, or about $2.50 per day of twelve hours, in which from ten to twelve charges of from 2,000 to 3,000 lb. each are annealed.





AT LEFT—WESTINGHOUSE BRASS TUBE ANNEALING FURNACE AT PLANT OF THE FRENCH MANUFACTURING COMPANY.
AT RIGHT—HAYES ANNEALING FURNACE AT THE FACTORY OF THE AMERICAN STANDARD WATCH CASE COMPANY

Economy Over Wood Fuel

As a result of the use of electricity here, the working conditions have been greatly improved, guesswork has been eliminated in the annealing operation, and there has been a decrease in the amount of oxidation that has cut down the "pickling time" 50 per cent. This has decreased the amount of acid consumption for pickling and increased the weight of brass tubing available for sale after drawing. A saving of one or two men per ten-hour day on annealing and pickling and of one man per day handing wood is an established fact. This alone more than pays for the extra cost of electricity, and every charge is subjected to the heating conditions that experience has shown gives the best tube for drawing, with scientific, accurate and automatic control.

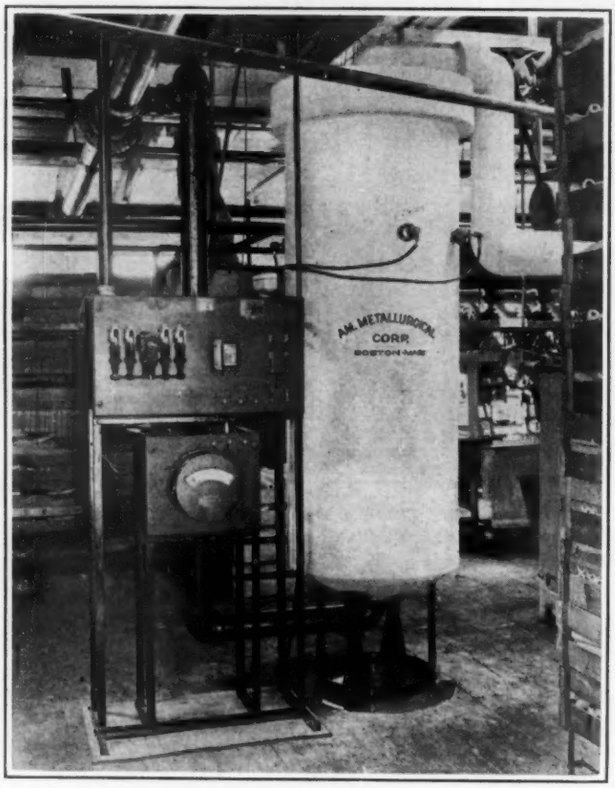
In the co-operative heating course this year it was stated that the General Electric Company succeeded in cutting its annealing costs in two by the use of the electric resistance furnace. In a fuel type furnace it is difficult to avoid scaling and wrinkling of sheet brass, with burning of the edges. Due to the localized temperature necessary for combustion, muffle or baffle type furnaces are necessary, with their attendant low efficiency and non-uniform heating effects. These drawbacks are not associated with the electric furnace. The American Brass Company has cut its rejections practically to zero by electric annealing.

Copper.—The annealing of copper is usually performed in a water-sealed furnace, the process being denoted "bright annealing." If the furnace is oil-fired, a muffle must be used, with serious loss in production when replacement is necessary. Close temperature control is necessary, and electric heating meets the requirements to the dot.

The General Electric Company has enjoyed notable success in the bright annealing of copper wire, using an electric furnace of the elevator type, with water seal. One furnace is 8 ft. long, 3 ft. wide and 5 ft. high, and has a connected load of 350 kw. The average charge is 8,000 lb., and the bake lasts from forty-five to ninety minutes, the approximate temperature being 800 deg. F. A production of from 20 to 25 lb. per kilowatt-hour is obtained. Supplementary steam is utilized in the annealing process. Another very fine installation for bright annealing of copper is successfully operated at the French Manufacturing Company's plant previously mentioned. It is gratifying to find that in notable instances the life of the copper is increased by electric annealing, with ability to withstand severe

vibration because of the absence of crystallization and maintenance of uniform quality.

Glass.—In glass annealing the ratio of material cost to fuel cost is so high that quality production and the ability constantly to duplicate results are of controlling importance. Improper heating soon leads to excessive breakage, owing to the fragility of the material undergoing treatment. In annealing it is essential to approach closely the critical point of glass, but not to exceed it, and the ability to do this quickens the anneal and increases production. With electric furnace automatic temperature control this condition can be obtained and "rejects" almost eliminated. The rate of both heating and cooling must be more carefully regulated than with metal. Strains set up by improper cooling or by overheating may cause the glass to break a few days after the annealing process has ended, thus further increasing



COMPRESSED AIR HEATER IN THE PLANT OF THE SEAMLESS CONTAINER COMPANY

the cost through wasting the labor and handling applied subsequent to the annealing process.

Electric annealing of glass has given a good account of itself in the incandescent lamp industry, in lens manufacture and very recently in watch crystal production. In the last application, C. I. Hayes, electric heating engineer, Providence, R. I., designed a furnace that virtually eliminated rejects in an establishment that was newly undertaking this kind of manufacturing and that ran as high as 80 per cent spoilage when using gas flame annealing. This high loss rate was unquestionably due in part to the inexperience of the factory, but it is interesting to be able to credit the electric furnace with so great and so immediate improvement of conditions. The furnace installed by Mr. Hayes is of the box type, rated at 10 kw., and operated on a 220-volt, single-phase circuit. The net electric rate is about 2.5 cents per kilowatt-hour, and the temperature requirements are from 900 to 1,100 deg. F. Automatic temperature control is within 10 deg. of the setting, and the cycle requires only about four hours' use of energy out of twenty-four, the load being cut in the early forenoon and then switched off, "coasting" as the anneal progresses. Rejections on account of discoloration formerly caused by the gas flame have been eliminated in the electric furnace.

Iron and Steel.—Until about four years ago the commercial annealing of iron and steel was generally carried on in fuel-fired furnaces, and these are still widely applied. However, a demand for the more accurate and uniform heat-treatment of metals, including the closely allied processes of annealing, aging and normalizing, has developed, and the electric furnace is competing more and more actively in these fields. A valuable feature is that in many cases this service can be performed at night on off-peak central-station rates, charging the furnace toward the end of the day, setting a time switch to cut off current at a predetermined hour before morning, and frequently using the same furnace on other work during the daytime. On a fuel cost basis, it has thus far been very difficult for the ele tric furnace to meet the bare expense for coal, coke, oil or gas; but over and over the advantages of electric heating have resulted in a lower over-all cost for a given quality of product. Reduced losses from scale, elimination of hard spots from uneven heating, which tend to slow down machining operations and cause breakages, and the doing away with annealing boxes count heavily in favor of the electric furnace when applied after careful analysis of conditions. The uniform grain structure secured electrically is arousing constantly growing interest.

HEAVY CASTING ANNEALING

The electric furnace is entering the field of heavy casting annealing and making a good name for itself there. The so-called car bottom type of furnace is making headway, and the General Electric Company has made a number of notable installations. One serves a plant which ages iron castings weighing in the vicinity of 50 tons. Uniform heating was not obtained under the former fuel-fired arrangement, but with electricity even this large installation operates with less than one-third the temperature variation of the former method. The furnace is 16 ft. wide, 28 ft. deep and 8.5 ft. high inside; it is equipped with 720 kw. in ribbon type windings. The castings are heated to 1,000 deg. F. Power is kept on for from twelve to fourteen hours and it is then cut off and the charge allowed to cool for thirty-six hours, when it is removed.

Another furnace rated at 200 kw. is of the car bottom type and anneals steel castings in a foundry. The average charge is about 8 tons, and annealing is at 1,600 deg. F. A third installation contains fourteen electric furnaces of the elevator type aggregating 2,200-kw. rating. Silicon steel sheets and punchings are annealed. Here the over-all cost of annealing has been cut about 50 per cent. Considerable heat is saved by the use of a sand seal in connection with the car bottom charge container. One of the smallest furnaces in this plant turns out eleven heats of 3.5 tons each per week with 130 kw. connected load and the energy consumption is 11 kw.-hr. per hundred pounds.

Motor Control for Valves

Montaup Electric Company Uses Central Control System for Closing Boiler Valves at Somerset Station—Emergency System Provided

BY CARL J. SITTINGER
Stone & Webster, Inc., Boston, Mass.

WITH the increasing size of steam power stations, together with the higher steam pressures that are now being used, it has become more and more desirable to equip the main steam valves in these plants with motor control. In fact, for quick closing of boiler lead valves and for routine operation of the larger valves such form of control is practically imperative.

At the Somerset (Mass.) station of the Montaup Electric Company motor control equipment has been incorporated on the 10-in. non-return valves and the 10-in. stop valves on each boiler, the 18-in. sectionalizing valves in the main header and the 18-in. turbine lead valves. In normal service both the non-return and the stop valves of each boiler are operated from a single control station mounted on the boiler gage board located in the firing aisle in front of the boiler, at which point both valves may be closed simultaneously. These valves must always be opened manually. The header sectionalizing valves and the turbine lead valves are each normally opened or closed from control stations mounted on the wall near the valves. An additional closing station for normal operation of the turbine lead valve is also provided on the turbine gage board.

As all the main steam valves in this plant are motor operated, it was decided that a comprehensive scheme of emergency operation of these valves would be justified, since the added expense of such an installation was small compared with the benefits of quick closing in case of trouble.

All motors controlling the steam valves are of the direct-current type, designed to operate over a range of 90 to 140 volts, and are supplied directly from the station control storage battery. An unfailing source of energy is thereby insured. The general scheme of emergency operation of the valves for the ultimate station with twenty boilers and six turbines is shown in Fig. 1. It will consist of two emergency control boards located at ground level on the condenser floor, one being placed near the southerly exit and the other near the northerly exit. Each board controls the emergency closing of all turbine lead valves and the non-return valves and stop valves of the four boilers in the center section of the plant, together with the header sectionalizing valves either side of this section. In addition,

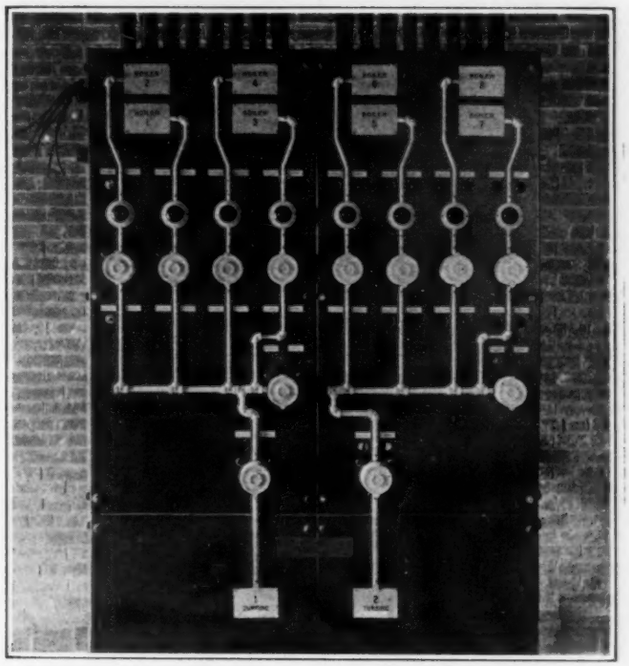


FIG. 2—VALVE CONTROL BOARD FOR EIGHT BOILERS AND TWO TURBINES

the board at the northerly end controls the balance of the valves for the eight boilers and header at the north end of the plant, and the board at the southerly end similarly controls the balance of the valves at south end of the plant.

It is hoped that with this arrangement any trouble in the entire steam circuit can be promptly and completely isolated. In the initial and immediate future installation of six boilers and two turbines only two sections of the southerly board have been provided and the northerly board has been omitted. Temporary closing stations for controlling the turbine lead valves, however, have been located at the northerly exit.

Fig. 2 is a view of the initial installation. It will be seen that on the board is represented a mimic diagram of the main steam piping. The position of the valves, whether opened or closed, is shown respectively by red or green bull's-eye indicating lamps. The control push buttons for emergency closing of the valves are inclosed in cast metal cases with spring covers. A large red bull's-eye lamp is shown on each boiler steam lead between the indicating lamps for the non-return valve and the stop valve immediately above the control station. These lamps operate from pressure devices connected to

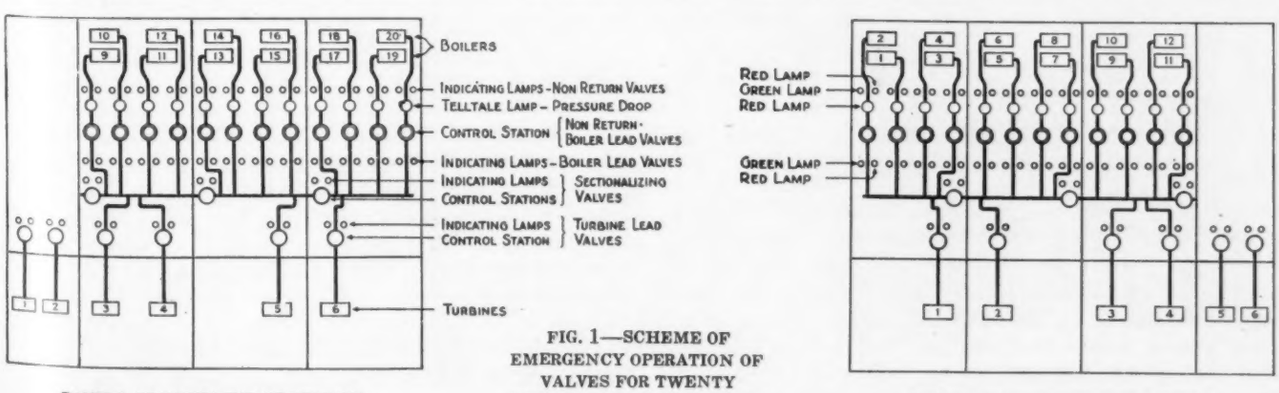


FIG. 1—SCHEME OF EMERGENCY OPERATION OF VALVES FOR TWENTY BOILERS AND SIX TURBINES

MOTOR-OPERATED VALVES AT SOMERSET STATION

Service	Quantity, Size and Manufacturer of Valve	Size or Type of Control Unit	Manufacturer
Non-return	3, 10-in.; Schutte & Koerting Co.	A-5 90–140 volts, d.-c.	Payne Dean, Ltd.
Boiler lead	3, 10-in.; Pittsburgh Valve, Fdy. & Const. Co.	A-3 90–140 volts, d.-c.	Payne Dean, Ltd.
Header sectionalizing	1, 18-in.; Pittsburgh Valve, Fdy. & Const. Co.	A-5 90–140 volts, d.-c.	Payne Dean, Ltd.
Turbine lead	1, 18-in.; Pittsburgh Valve, Fdy. & Const. Co.	A-5 90–140 volts, d.-c.	Payne Dean, Ltd.
Fuel oil supply	2, 10-in.; Pratt & Cady	A-3 90–140 volts, d.-c.	Payne Dean, Ltd.
Circulating water	4, 36-in.; Pittsburgh Valve, Fdy. & Const. Co.	A-4 220 volts, 60-cycle, single-phase	Payne Dean, Ltd.
Intake gates	4, 84-in.; Coffin Valve Co.	KT-180 motor, CR7009 contactor LS-80 limit switches, 550 volts, 60-cycle, 3-phase	General Elec. Co.

the boiler leads and indicate when the steam pressure drops 50 lb. below normal in the lead to which they are connected. In this way the board shows immediately the location of the center of disturbance in case of faults in the steam lines or their connections, and by closing the valves adjacent to the point or points where the fault is indicated, the trouble can be quickly isolated or removed.

Another emergency application of motor-operated valves is in connection with the fuel oil supply system. The 1,200-bbl. fuel oil service tanks in the station are filled by gravity through two 10-in. pipe lines from 55,000-bbl. storage tanks located across the highway from the main property at an elevation about 40 ft. above the service tanks. To guard against overflowing of the tanks and flooding the surrounding property with fuel oil each line is equipped with a totally inclosed type direct-current motor-operated valve. Heavy floats with rods and calibrated scales indicate the level of the oil in the tanks. An alarm is sounded when the level exceeds a predetermined limit and if the valves are not closed manually at this time, a further rise of the floats closes a vaporproof float switch, which in turn operates the closing circuit of the valves. The valves are normally open or closed from control stations mounted on the wall near the valves.

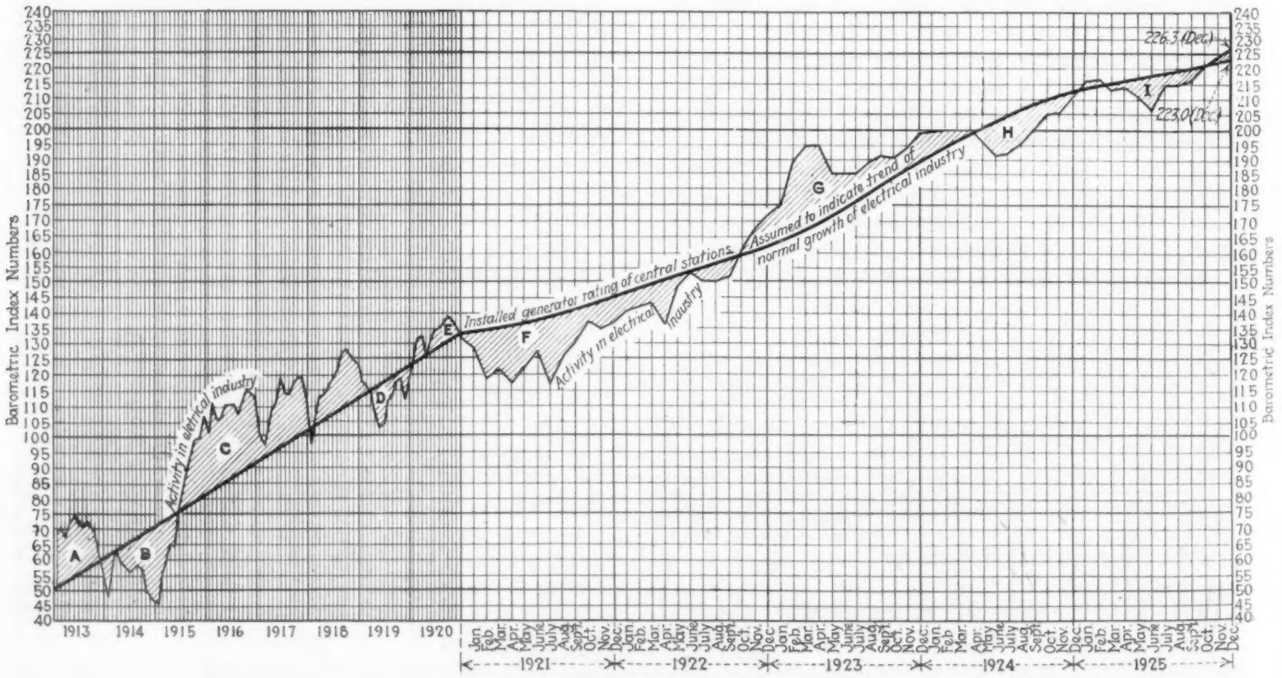
In addition to the motor-operated valves above enumerated, the 36-in. circulating water valves and the 7-ft. intake gates are motor operated from the regular station, 60-cycle supply; the former, at 220 volts, single phase, is controlled at a circulating pump motor switchboard and the latter, at 550 volts, three phase, from push-button stations in the intake screen room.

The accompanying table gives a list of the motor-operated valves in the present installation.

Industry on a High Wave of Prosperity

THE opening of the new year found general industry on a high wave of prosperity with roseate future prospects. Activity in a large number of the primary industries was the highest recorded since 1924. Pig iron, a generally accepted barometer of general business activity, reported activity very close to the estimated normal for the month. All students of industrial conditions seem to agree in the conclusion that the first half of the year will witness general prosperous conditions. Few are attempting to predict conditions beyond the middle of the year.

As a result of these excellent industrial activities the ELECTRICAL WORLD'S "Barometer of Business Conditions in the Electrical Industry" indicates that the activities of the industry during December were above those of November, and that during December the industry was operating at 3.3 per cent above the estimated normal for the month. In November it was operating at 1 per cent above normal and in October at 0.4 per cent below normal. Incomplete reports indicate that the electric light and power branch of the industry was operating at 3.2 per cent above normal during December.



ELECTRICAL INDUSTRY OPERATING AT 3.3 PER CENT ABOVE NORMAL DURING DECEMBER

Letters from Our Readers

Unappreciated Advantages of the Electric Range Load

To the Editor of the ELECTRICAL WORLD:

As we study the development of electrical service in the home through the activities of progressive merchandisers we cannot help noting the lukewarm attitude of many central-station companies toward the electric range. Judging from recent tests reported by the N. E. L. A. range committee, it appears that the often unappreciated range load at 3.5 cents per kilowatt-hour will when properly developed produce nearly $90 per year per kilowatt of demand on the limiting peak, and in most large stations this peak occurs in the forenoon. In the light of reported operating figures it looks very much as if old notions as to the undesirability of the range load will need to be materially revised, even though with active development additional feeders, distribution and transformer capacity may eventually necessitate a considerable added investment to maintain efficient service.

With adequate sales it does not seem unreasonable to expect that the station demand resulting from residence service alone can be doubled and in some cases tripled within the next ten years, with satisfaction to the company and the customer alike. It is my belief that the electric range load is of great potential value and worthy of renewed consideration by service companies. It appears that the time has arrived when the range should be intelligently and systematically merchandised in an energetic way along with other energy-using devices of a promotional nature, such as the household refrigerating machine.

Those of us who have used a modern, automatically controlled electric range in our homes and have for any reason been obliged again to go back to the ordinary cooking devices, even for a comparatively short time, have discovered that there are real and practical reasons why the housewife who *knows* the electric much prefers this appliance to the latest and best of the fuel ranges. The complete and dependable control, practical saving of time for other work about the home and minimum wastage of food, as well as the added safety and healthfulness incident to the use of electricity rather than fuel, make a compelling appeal to the housewife in favor of the electric range. Up-to-date competitive equipment, which even then in some respects is inferior to the electric, costs as much as or more than the best electric range. When we come to more moderate-priced equipment, it is believed that the real appeal is still in favor of the electric.

The big stumbling block in the way of a satisfactory development of this most valuable load seems to be the lack of recognition of opportunities on the part of service company managements. The field is wide open and ready for cultivation. The goods are available and ready to be sold. The electric range is no longer an experiment. The new service will be appreciated because it is superior to any other, but too many service companies hesitate really to go after this valuable load.

The real limiting peak from the range load generally occurs in the forenoon during the time of the maximum industrial load. Recent tests by the N.E.L.A. committee have indicated that during this time even with 7.5 kw. connected per range the average demand incident to the range load is approximately 0.6 kw. at the generating station, although this range demand at 5.45 p.m. to 6.15 p.m., when the industrial load is off, is approximately twice as much as during the morning hours. This condition means that generally, in computing necessary generator capacity, one can use the smaller figure because of available capacity in the evening when the industrial load is at a low point.

On this basis the necessary investment per range will be very much less than usually figured; hence the need of going into this subject again and in the light of actual attainment, as proved by recent tests in the Northwest, where there is saturation enough to provide dependable data. The average electric range uses not less than 1,500 kw.-hr. per year. If we figure the generating station demand at 0.6 kw. per range, this means that the usage per kilowatt of limiting demand at the station is 2,500 kw.-hr. When one considers that this is an additional load on existing service, one can appreciate that even at 3.5 cents per kilowatt-hour the operating ratio for this supplemental load is at least as good as for existing loads.

Stone & Webster, Inc.,
Boston, Mass. NORMAN T. WILCOX.

Acquisitions of North American Company During 1925

To the Editor of the ELECTRICAL WORLD:

In the issue of the ELECTRICAL WORLD for Jan. 2, page 26, an error appears under the list of properties acquired during 1925 by the North American Company. In correct form this list would be as follows:

	Capitalization
Western Power Corporation	$137,163,964
Mississippi River Power Company	45,436,875
Central Mississippi Valley properties	1,982,666

North American Company,
New York. CHARLES E. NEIL.

Standard Voltages in France

THE French government has lately issued a regulation setting forth the standards to be adopted in connection with the distribution of electricity in France. The order provides that the standard current shall be three-phase alternating current with a frequency of 50 cycles per second. The use of direct-current or single-phase, 50-cycle alternating current may be authorized for important transmission lines, for traction purposes and in certain rural areas. The permitted voltages are as follows: For direct current—115-230 volts and 460 volts; for single-phase alternating current—115 volts and 230 volts; for three-phase alternating current —115-200, 230-400, 1,000, 3,200, 5,500, 10,000, 15,000, 22,000, 30,000, 45,000, 60,000, 75,000, 90,000, 110,000, 150,000, 220,000 and 300,000 volts. It is further provided that the Minister of Public Works may, after consultation with the government Comité d'Electricité, permit variations from any of the standards. Where only a single voltage is stated, the tension represents the maximum existing between any two conductors in the system. In the case of direct current or single-phase alternating current, if the distribution system has a neutral wire, the voltages given represent the tension between the extreme conductors, which must be equal to twice the tension between the neutral conductor and either extreme conductor.

Central Station and Industrial Practice

Special Crossing Spans for 220-Kv. Line

BY L. J. CORBETT,
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Cal.

BUILDING a 220-kv. transmission line with spans up to 4,135 ft. in length over nearly five miles of delta lands near the confluence of the Sacramento and San Joaquin Rivers east of San Francisco Bay presented some problems to the engineers of the Pacific Gas & Electric Company not ordinarily encountered in such design. The problem was made doubly difficult by the fact that two of the spans must clear navigable waterways, necessitating four towers ranging in height from 314 ft. to 459 ft., with no ground near by suitable for deadending.

The plan adopted for this crossing is to have the tension in the conductors held by low, strong anchor towers situated well back from the river banks, and to support only the weight of the conductors and the wind load on high towers at the long spans. The maximum pull expected in each conductor is 20,500 lb., which will be held by a quadruple string of high-strength insulators at the anchor towers at each end of each river crossing. The maximum weight and wind load expected on any of the high towers is 8,600 lb., which will be held by a double string of high-strength insulators at each support. The load on the double strings will be equalized in the ordinary manner on suitable yokes, the cable resting on a cast-steel saddle.

At the anchor towers four strings of insulators will be combined as a single compact mechanism with a string at each corner of the square section. The load will be equalized across the diagonals of the square in order to limit the movement in case one insulator string breaks. The conductors on the river crossings will be mixed extra high-strength copperweld and copper, nineteen-wire Warrington strand, concentric lay 0.947 in. in diameter, composed of four sizes of wire.

Vertical separation between conductors of the same circuit will be 25 ft. and the horizontal separation between circuits 38 ft. In the standard sections of the line, as on the company's Pit River transmission line, the corresponding separations are 15 ft. and 24 ft. respectively. The insulator strings on the river crossings will be about 50 per cent longer than on the standard sections, and the clearance to tower parts about 50 per cent greater. The section between anchor towers on Sherman Island (see accompanying diagram) will be 500,000-circ.mil copper conductor, and the standard towers will be such as already used on the company's Pit River transmission line. The line is being designed for 220 kv., but will operate initially at 110 kv.

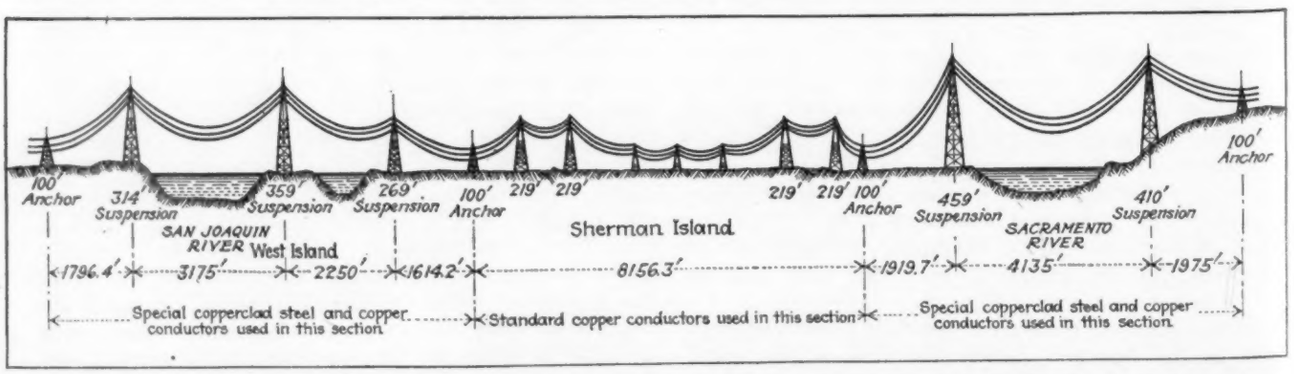
Voltage Regulator Attention Improves Service

Suggested Routine Inspections that Will Keep Regulating Devices in a Satisfactory Condition and Result in Successful Operation

BY CHARLES R. SCHULER
Commonwealth Edison Company, Chicago

SATISFACTORY operation of voltage regulation equipment, like many other pieces of electrical equipment, demands expert maintenance attention at regular intervals. This is particularly true of the contact-making voltmeter, which is a delicate, finely adjusted instrument in which any defect will interfere with its operation and often render the regulating equipment worse than useless. Daily inspection should be made to see that the regulator is on automatic control, to inspect motor fuses and the condition of the apparatus generally. Once a week the inspector should see that the regulator responds to the action of the contact-making voltmeter. This can be accomplished by manually closing the relay switch until the regulator has run nearly full choke or full boost. If the contact-making voltmeter and regulator are operating correctly, the voltmeter will bring the regulator back to its original position when the relay switch is released. Lubrication, electrical connections and braking surface should also be given regular attention.

The contacts for contact-making voltmeters are subject to considerable wear and need a great deal of attention to keep them in good working order. If they are too far apart, the pressure will be irregular. If too close together, the regulator



PROFILE OF 220-KVA. TRANSMISSION LINE CROSSINGS OVER LOWLANDS NEAR MOUTH OF SACRAMENTO AND SAN JOAQUIN RIVERS

motor will race—that is, run in one direction and then in the opposite direction. If this condition persists, the motor heats and very often burns out. Change of range or effective distance between contacts is caused by change in the adjustment of the spring supports or by wear of the contacts themselves. Sometimes the contacts will be sprung far enough out of their normal position during cleaning operations to increase the range of the contact-making-making voltmeter three or more volts. If the contacts become pitted and stick, the regulator will run full boost or full choke. In some cases both the boosting and choking contacts stick at the same time, resulting in the overheating of the motor. Consequently, when the contacts are cleaned or replaced, the contact-making voltmeter should be adjusted for range.

Holding coils need periodic inspection to insure their correct action. Their function is to hold the contactor firmly together by energizing the holding coils at the slightest contact of the relay contacts. Arcing of the contacts is prevented thereby and the wear on them reduced. If the holding coils are adjusted to hold the contacts together too long, the regulator will override and racing of the motor is likely to result. If they are released too soon, arcing and wear of the contacts of the contact-making voltmeter result.

Wear of the plunger guide pin may be aggravated by a small amount of arcing due to current leakage if certain classes of slate are used to mount the contact-making voltmeter. The wear makes the contact-making voltmeter sluggish and uncertain.

If the pin connecting the beam arm and the plunger of the contact-making voltmeter is not exactly or symmetrically made, it will bind in certain positions and act as a damper on the voltmeter.

Occasionally the shaft of the plunger loosens, due to the iron core being improperly bound. This results in longitudinal shifting of the shaft with respect to the plunger, and will raise or lower the pressure a fixed amount, thus changing the no-load setting.

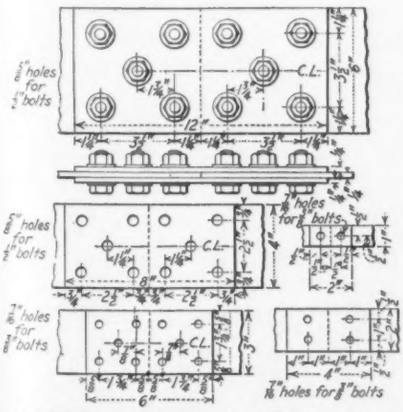
Arcing of the relay switch that operates the regulator motor will slow up the operation of the regulator or blow the motor fuses, depending upon the type of relay switch employed. In the older types the arcing slows up the action of the motor and results in voltage variation on the line In some of the later types it is possible for both contacts to arc at once. This usually blows the motor fuse and stops automatic regulation, leaving the phase subject to a fixed boost or choke, depending on the position of the regulator at the time the fuse was blown.

Brakes of the permanent type sometimes loosen or oil reduces their effectiveness. This allows the regulator to overrun and in some cases the motor will operate in one direction and then the opposite direction, alternately. Such action gives poor voltage regulation and imposes a severe duty on the regulating equipment. If the brakes are set too tight, the motor may not be able to start, causing the fuses to blow. Magnetic brakes cause trouble very infrequently if properly lubricated.

Daily inspection of regulating equipment is necessary to reveal blown motor fuses. This condition may result from defective motors, motors reversing constantly on account of defective brakes, incorrect adjustment of contact-making voltmeter contacts, improper adjustment of holding coils and arcing of the reversing switch contact.

Due to wear of rotor bearings or variations in the manufacture, regulators will sometimes vibrate considerably. If the contact-making voltmeter is mounted so as to receive the vibrations they will affect adjustment and increase the wear on its moving parts.

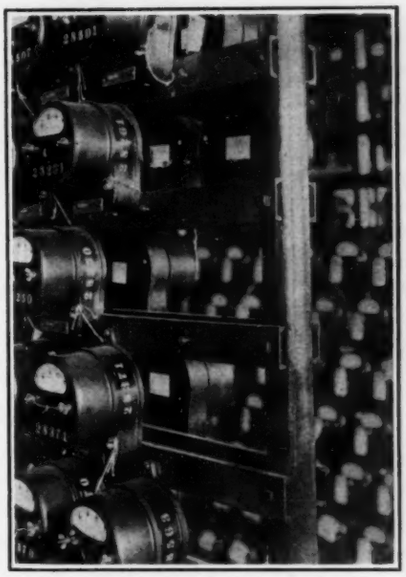
Method of Joining Copper Bars



IN THE accompanying illustration is shown the standard method used by the Utica (N. Y.) Gas & Electric Company for joining copper bars used for bus work. The sizes generally used are 1, 2, 3, 4 and 6 in. In making these joints the surfaces in contact are tinned. They are then bolted and sweated together.

Non-Adjustable Meter Storage Rack Built of Pipe

A METER storage rack which, though all parts are readily accessible, occupies a comparatively small space was built by the Connecticut Light & Power Company to fill a long-existing need for a fireproof, rigid rack with no adjustable parts and of light construction. The



CONSTRUCTION AND SPACING OF NON-ADJUSTABLE METER RACK

meter foreman can see at a glance on the new rack the number of meters of all types in stock, how many are tested, the number to be repaired, when those to be condemned reach an amount to be handled economically, the exterior condition of all meters and when to order more meters of any capacity.

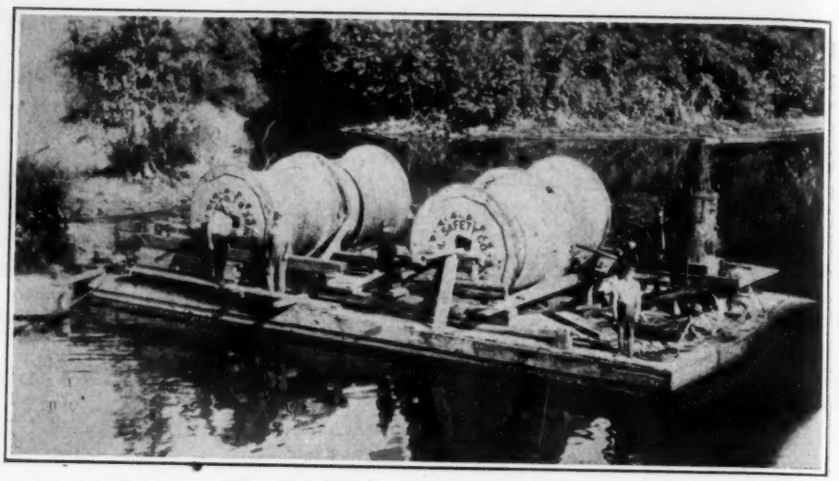
The complete rack is made up in six parallel sections spaced 5 ft. apart on centers, each measuring 10 ft. wide and 10 ft. 6½ in. high. The backbone of each section consists of four 2-in. pipes spaced 3 ft. apart, which are fastened at the bottom to a 5½x7½-in. pine timber to spread the resulting weight over a greater area and at the top to four 2-in. horizontal pipes. Bolted to the upright pipes are lengths of 2-in. channel iron spaced vertically at various distances depending on the type of meter to be hung. The flat side of the channel iron is placed out to give the same area as solid strips without the extra weight.

The entire area on both sides of each section can be utilized for hanging meters. As the first three sections are spaced for type I-14 meters under 50-amp. capacity, both

sides of each section are alike and one ⅜-in. bolt passing through each vertical pipe fastens a channel iron on each side. On the three other sections this does not work out so well, due to unequal spacing on both sides.

Along the center line of each channel iron, holes were drilled and tapped for ¼-in. round head machine screws, which were inserted to the proper depth and held with a lock-nut at the back of the channel iron. Though this method of attaching the screws is somewhat expensive, it provides a rigid screw and permits changing the distance of the screw head from the surface to allow for changes in meter construction. The meter when hanging on the rack has an ample flat bearing surface both at its point of suspension and at its lower point of contact with the rack. By means of staggering, the meters are placed closely together with no waste space, though they are far enough apart to allow each one to be placed in position or removed without disturbing the others. The horizontal spacings of meter screws are 6½-7-9-11 in. and the vertical spacings are 7-8-9-10-12-15 in. With these spacings any modern meter can be hung.

Each side of the first three sections holds 217 type I-14 meters in sizes below 50 amp., so that 1,302 meters are stored in a space 10 ft. wide, 8 ft. 2 in. high and 15 ft. long, with every meter accessible. A ladder on wheels is provided to reach the meters on the top rows, the meter-supporting screws being 8 ft. 11 in. from the floor. The remaining three sections in a similar space contain only 761 meters of the larger and special types. Shipments of 5-amp. meters are received in lots of 500 and can be unpacked, stenciled and placed on the rack as soon as they are received.



FOUR SINGLE-CONDUCTOR 33,000-VOLT CABLES LAID AT ONCE BY BARGE GUIDED BY ANCHORED GUY WIRE AND PROPELLED BY ENGINE-DRIVEN WINCH

Single-Conductor Cable for Submarine Circuits

RATHER than use the customary three-conductor cable for making the submarine connection between its station at Lacon, Ill., and Sparland, the Public Service Company of Northern Illinois turned to an installation consisting of four single-conductor, 38,000-volt cables, which has been completed and put into service recently.

Four single-conductor cables in all were laid—three for regular use and one to be cut into service in case a breakdown occurs on one of the three others. Each cable consists of a No. 4/0 copper conductor covered with $\frac{33}{32}$ in. of wrapped paper insulation and the whole surrounded with a $\frac{5}{64}$-in. sheath of lead. The lead in turn is covered with jute tightly wound with No. 6 armor wire and surrounded with another layer of jute. The over-all diameter is 3½ in. and the weight is 14 lb. per lineal foot. Each cable is 1,890 ft. long and terminates on steel towers erected at each side of the river, with disconnecting switches so arranged that the spare cable may be switched to take the place of any one of the three others that may break down.

In laying this cable numerous construction difficulties were encountered. It was necessary, for example, to keep the barge that paid out the cable moving in a straight line from one bank to the other. This was accomplished by stringing a ⅜-in. guy wire between anchors on each side of the river to act as a guide. A barge 50 ft. long and 30 ft. wide was used. The large cable reels were rolled on board and an engine-driven winch was used to move the barge along its guide. The four cables were laid at the same time, properly spaced.

Use of Two-Phase Motors Decreasing

THE trend toward three-phase distribution continues in this country. A recent survey by the statistical department of the ELECTRICAL WORLD shows conditions in industry in 1920 and in 1925. This tabulation does not cover all the

USE OF TWO-PHASE MOTORS IN MANUFACTURING PLANTS AS INDICATED BY SURVEYS MADE IN 1920 AND 1925
(Same companies included as nearly as possible)

Industry	Total Number of Reporting in Companies 1920	Number of Companies Reporting Use of Two-Phase Motors in 1920	Number of Two-Phase Motors in 1920	Horsepower of Two-Phase Motors in 1920	Total Number of Companies Reporting in 1925	Number of Companies Reporting Use of Two-Phase Motors in 1925	Number of Two-Phase Motors in 1925	Horsepower of Two-Phase Motors in 1925
Chemicals and allied products	137	28	1,267	24,925	137	13	1,260	18,600
Foods and kindred products	270	32	2,498	29,074	270	27	1,238	17,380
Iron and steel and their products	1,029	151	13,367	152,914	1,029	69	8,740	105,000
Leather and its finished products	104	19	426	2,412	104	7	272	2,100
Lumber and its products	247	33	1,026	6,768	247	13	561	6,410
Machinery	125	32	20,800	41,000	125	16	10,397	92,222
Metals and metal products	121	32	1,964	14,461	121	16	1,327	11,270
Musical instruments	3	2	15	144	3	2	15	144
Paper and printing	107	22	1,080	22,696	107	4	81	1,580
Railroad repair shops	28	4	452	9,430	28	3	1,015	16,487
Rubber products	52	12	745	11,126	52	2	267	5,200
Stone, clay and glass	138	33	862	10,397	138	2	91	1,540
Textiles and their products	673	151	9,457	61,640	673	136	17,540	144,500
Tobacco and its products	28	12	374	2,622	28	14	1,260	2,630
Transportation	68	13	1,278	16,366	68	10	1,212	14,850

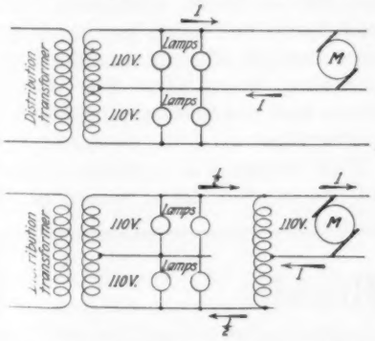
polyphase applications in this country, but it covers a sufficiently large proportion to indicate how three-phase distribution is advancing.

Reducing Lamp Flickering with an Auto-Transformer

BY W. F. HENN,
Transformer Department,
General Electric Company

AT TIMES a small 110-volt motor is installed at the end of a three-wire secondary distribution feeder serving a lighting load in a residential section. The current drawn through the secondary mains by this motor will produce an appreciable drop in voltage, with a corresponding flickering in the lamps connected to the same circuit. This flickering of the lamps invariably leads to complaints on the part of the customer of the central-station company, and Type M auto-transformers have been used with success in reducing this fluctuation in voltage.

The manner in which this reduction in voltage drop is obtained may be seen by referring to Fig. 1, which shows the condition prevailing before the auto-transformer is installed. Assuming balanced lighting load conditions between the outside wires and the neutral wire, the 110-volt motor will draw a current *I*, which will produce a voltage drop in



HOW LAMP FLICKERING IS REDUCED BY MEANS OF AUTO-TRANSFORMERS

the outside wire as well as in the neutral wire, causing the lights on one side of the circuit to fluctuate.

Fig. 2 shows the conditions when the motor is connected to the lines through the auto-transformer. By means of this connection, the current drawn from the lines is just half its former value and is equally distributed over both branches of the circuit, and the drop in the neutral wire is eliminated. Thus, the voltage drop is only one-fourth of its previous value across one branch of the circuit, and is reduced to one-half in the other branch.

Electric Welding Costs

A PERTINENT comparison between electrically welded and riveted repairs in plant maintenance is given by the Lincoln Electric Company of Cleveland, Ohio, in a report on arc welding. Two 4x4-in. patches were put on a dust chute in a cement mill by the two methods with the following relative costs:

Riveted Patch Two men, two hours		Welded Patch One man, five minutes	
Drill holes	$1.20	Welding	$0.08
Fit up	.60		
Rivet patch	.60		
Total cost	$2.40	Total cost	$0.08

An incidental, but not unimportant, economy of electric welding is that in many cases the apparatus or machine does not have to shut down while the repair is being made.

Estimated Cost of 14.7-Mile, 110-Kv. Line

THE New England Power Company is planning to build a two-circuit, single-tower, 110-kv. line from Millbury, Mass., to the Milford-Medway town line, for interconnection with a Boston Edison 110-kv. trunk line to be run to Medway from the Edgar station, and the estimated cost of this link is given in the accompanying table. The section from Millbury to the Medway line is approximately 14.7 miles long, and includes towers designed for 12-ft. horizontal conductor spacing, with two three-phase circuits per tower, each to be of No. 4/0, B. & S. seven-strand, bare, hard-drawn copper having a strength of approximately 8,400 lb. and sagged to reach a tension of 4,000 lb. when carrying a load of 0.5-in. ice and 8-lb. wind pressure at 0 deg. F. The power insulators will be of the ball-and-socket, 10-in. disk type, with eight disks in suspension and nine in strain. There will be 6.6 towers per mile and the clearances (minimum) will be: ground, 20 ft.: highways, 25 ft., and foreign lines, 8 ft. The carrying capacity of each circuit will be 50,000 kw. A separate telephone line of two No. 6 solid bare copper-clad wires will be erected 60 ft. from the transmission line, on poles spaced 32 per mile.

ESTIMATED COST OF MILLBURY-MEDWAY LINE (14.7 miles)

Clearing	$29,800
Tower erection	67,400
Hauling and stringing wires	17,350
Towers	91,500
Power and ground wires	60,575
Insulators and hardware	16,600
Telephone line	17,850
Right-of-way, surveys and legal	73,500
Sub-total	$374,575
Contractor's expense, 10 per cent	37,458
Sub-total	$412.033
Engineering expense, 5 per cent	20,602
Estimated total cost	$432,635
Or, per mile	$29,450

Seventy-Foot Poles Reset After Twenty Years' Use

PROGRESS in methods and equipment as well as economic efficiency were illustrated by the reclamation, removal and resetting of two 70-ft. Western red cedar poles originally installed in 1905 near

TWO 70-FT. WESTERN RED CEDAR POLES FOUND SOUND AFTER TWENTY YEARS' SERVICE

Camanche, Iowa. After serving there for twenty years they were recently removed to Clinton, Iowa.

Of special interest is the change in methods of erection. In 1905 these poles were erected in two days with the labor of six men, one team and a driver, and by the employment of a 35-ft. gin-pole. The erection at Clinton was quickly accomplished by the use of a modern construction truck. Of economic interest is the salvage value of these poles (which were found "comparatively in as good condition as the day they were set"), being about 100 per cent, less the cost of removal. The construction superintendent on this job attributes this to the use of concrete at the bottom of the poles and at the ground line with crushed rock in between, providing a means of draining whatever water might soak in around the pole.

Commercial Activities and Public Relations

Benefits from Intensive Range Sale

Waukegan District of Public Service Company of Northern Illinois Adds 2,870 Hp. Cooking Load

DURING four months of the past summer more than 200 electric ranges with a connected load of 2,870 hp. and an annual revenue of $17,000 were sold by four regular salesmen of the Waukegan district of the Public Service Company of Northern Illinois. These 200 ranges, having a retail value in excess of $40,000, were sold with an average company stock of sixteen ranges valued at approximately $2,000, giving a stock turnover of approximately twenty to one for the four months.

OBTAINING PROSPECTS

Preliminaries for the four months' activities included personal letters to every prospective purchaser, referring to neighbors who were satisfied range users. Three-column advertisements were used in all local newspapers. The machinery of the company's "More and Better Business" plan were utilized, employees being offered $3 for every prospect turned in that resulted in a sale. One-third of all sales resulted from these leads. Cooking schools conducted by the company throughout the year prepared the way with many prospects by showing them what the electric range could do.

SALES METHODS AND TERMS

The four regular appliance salesmen of the district carried on the range sales along with their regular work. The men worked in their own territories where they were well known and where they were able to select the most likely prospects. Only one cancellation was recorded during the four months. Nineteen ranges purchased during the sale were exchanged for ranges with temperature-controlled ovens selling for $25 additional. After the first temperature-regulated range was sold, 80 per cent of the sales were of that type. The porcelain enamel-lined ovens were in great favor.

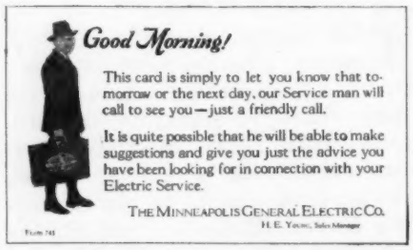
The average range rating was 7 kw. and the average sale price $200. On ranges selling for more than $150 an allowance of $40 was made for installation. On ranges selling for less than $150 the installation allowance was 25 per cent of list price.

The greatest activity in range sales was carried on in towns where gas service was not available. In these towns one out of every five range sales included a 5-kw. water heater.

The company's previous experience with sporadic extension of range service showed an average cost for line extension and service connection of practically 100 per cent of the first year's revenue from the range. Intensive cultivation of range business in given territories resulted in a closer grouping of ranges and a reduction in the unit cost of service extensions to only 20 per cent of the first year's revenue.

Byproducts of Customer Service

Aids Public Policy, Fills Empty Sockets, Keeps Appliances in Service, Serves as Emergency Information Bureau and Promotes Good Will


Good Morning!
This card is simply to let you know that tomorrow or the next day, our Service man will call to see you—just a friendly call.
It is quite possible that he will be able to make suggestions and give you just the advice you have been looking for in connection with your Electric Service.
THE MINNEAPOLIS GENERAL ELECTRIC CO.
H. E. Young, Sales Manager

OFFICIAL COMPANY SANCTION ASSURES SERVICE MEN ENTRANCE TO CUSTOMERS' HOMES

THE CUSTOMER service bureau of the Northern States Power Company not only supports the company's policy of keeping its customers informed and satisfied but has developed byproducts of particular value to the sales department. The representatives of the customer service bureau make 25 interviews per day, working in the same territory and cultivating the customer by making themselves so agreeable that they are welcomed on the next call.

The men inspect and make minor repairs to appliances out of service, bringing important repair work into the office. Many customers have been found not using certain appliances because of some mistaken idea regarding their use. The service bureau men get these appliances back into service.

While engaged in appliance inspection the men make a record of all

Tangible Results

Some of the Things That Have Been Accomplished in a Customer Survey During One Year in Minneapolis

Interviewed 26,846 customers.

Unearthed 1,124 complaints, all of which were taken care of and the customers satisfied and misunderstandings cleared up.

Made minor repairs on premises to 2,081 appliances, bringing them back into service.

Brought in for major repairs 178 appliances, likewise putting them back into service.

Turned in 255 prospects for the sale of preferred stock and 728 prospects for the sale of merchandise. These prospects resulted in the immediate sale of $25,188 in preferred stock and $2,405 in merchandise.

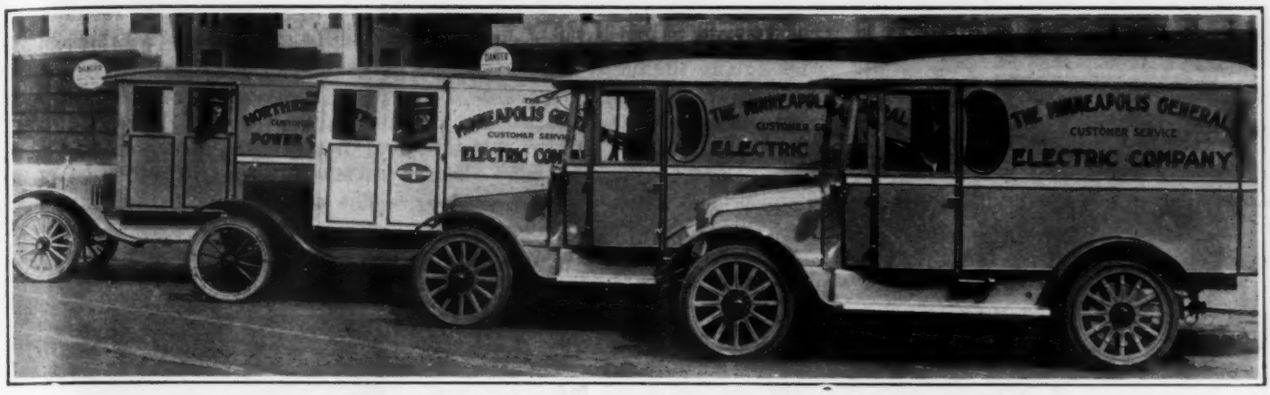
Sold 21,746 lamps to customers on the premises for immediate use.

Value of sales $8,469.

Wattage added to lines as result of above activities:

	Kw.
From appliances repaired..	611.4
From lamp sales	872.2
From merchandise sold....	57.7
Total	1,541.3

Estimated annual revenue from added wattage, $42,217.



FIFTY CALLS A DAY ARE MADE BY THE TWO MEN ON EACH CUSTOMER SERVICE TRUCK

appliances owned, and this record goes into the customer survey maintained by the sales department of the company. This survey is constantly in use when planning campaigns.

The discovery that nearly 40 per cent of the sockets in the average residence were without lamps led to the inclusion of a lamp-display case in the regular equipment of the customer service bureau representatives. The range of lamp size and styles displayed in this case gives the customer convenient opportunity to make a selection and to have the lamps placed in the sockets immediately. Lamps are the only merchandise sold by bureau representatives, but the profit realized helps defray the expenses of the bureau.

In their regular work the men use light delivery trucks, as shown in the illustration, two men with each truck, one man on each side of the street.

VALUE OF CLOSE RELATIONS WITH CUSTOMERS IN EMERGENCIES

Emergencies such as result from storms find the customer service organization serving as an emergency information bureau. The men are stationed at phones and keep in touch with customers whose service has been interrupted, informing them of what the company is doing to restore service. This attention, given to thousands of the company's patrons when they are inconvenienced, has impressed them with the fact that the customers' interests are always uppermost in the company's plans. This conviction among the users of its service that the company is at all times sincerely and assiduously doing its best to fulfill its obligation as a public utility is a business asset that is of very real value.

Station Exterior Floodlighted with 24 Kw.

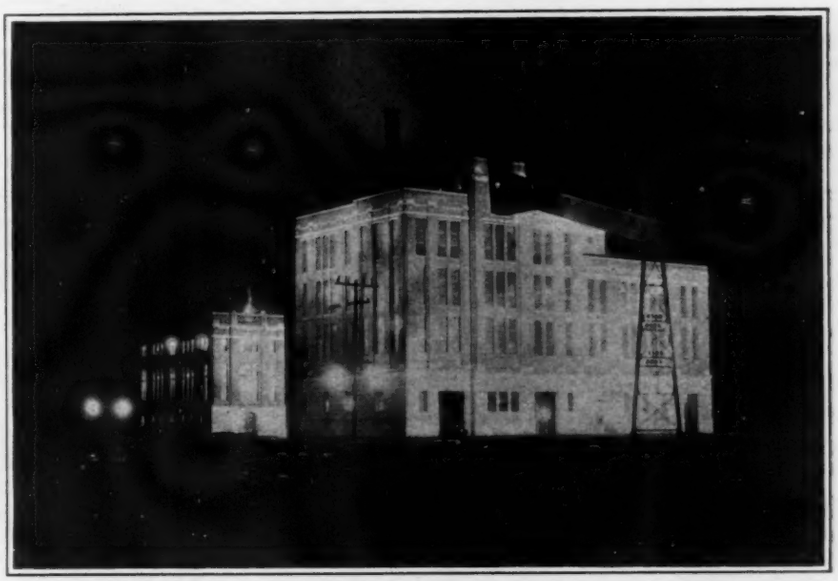
BY W. H. SNIDER
Electrical Engineer United Light & Power Company, Davenport, Iowa

THE exterior of the new base-load Riverside station of the United Light & Power Company, on the Mississippi River about seven miles above Davenport, Iowa, is floodlighted every night for advertising purposes. The accompanying illustration was taken with two banks of projectors turned on the south and west walls.

The west wall of the boiler room, adjacent to the switch house, is floodlighted by a bank of projectors mounted on the roof of the switch house. In this bank are sixteen 500-watt Type 60D and 60E X-ray projectors. They are mounted on two channel-iron racks having two shelves each and four projectors per shelf. The Type 60-E wide-spread units are used to flood the center portions of the wall and the Type 60-D units, with a beam spread of 20 deg., are focused on the outlines of the wall to bring out the edges and coping in sharp relief. The projectors are placed approximately 40 ft. from the wall and are adjusted to give an even intensity of 4.5 foot-candles. The net area covered is 8,000 sq.ft. and the power consumption is one watt per square foot of wall area.

The south walls of the switch house and main building are floodlighted by projectors mounted on the coal conveyor bent. In this bank are sixteen 1,000-watt type L-15 General Electric projectors. They have clear glass doors and a beam spread of 30 deg. From the bank to the building wall is 93 ft. The combined south wall area of both buildings is 19,000 sq.ft. and the intensity is 4 foot-candles. The power required is 0.85 watt per square foot of area.

Comparatively few utility power plants have been floodlighted on a



FLOODLIGHTED POWER PLANT OF UNITED LIGHT & POWER COMPANY NEAR DAVENPORT, IOWA

regular schedule, and this practice on the part of the United Light & Power Company marks a step in advertising not generally used by operating companies.

Public Inspection of New Power Plants

TO GIVE their customers a better conception of the extent of the system that supplies them with power and light those companies in the Pennsylvania-New Jersey superpower system of the General Gas & Electric Corporation have arranged a series of inspection trips to the generating stations. Groups of representative citizens from various districts have taken these trips, but recently nearly eleven hundred men, representing practically every industry, profession and business in the territory served, together with municipal officials, were taken to see two of the largest generating stations in the system. These were the first 35,000-kw. unit of the 200,000-kw. pulverized-fuel station on the Susquehanna River, near Harrisburg, Pa., and the 71,500-kw. station at Reading, Pa. Both stations are connected by high-tension lines with all parts of the Pennsylvania-New Jersey system, which extends about 250 miles through the two states.

Except for 100 guests of the Metropolitan Edison Company from Lebanon, Pa., the entire party was made up in Easton, Pa., and surrounding territory served by the Pennsylvania Edison Company and the extensive New Jersey region between Phillipsburg and Dover and Sussex and Lambertville served by the New Jersey Power & Light Company. There also were groups of both Lafayette and Lehigh engineering students. Three special trains were required to handle the guests, some of whom traveled 350 miles during the day.

A large corps of employees of the three companies acted as guides at the power stations and as attendants on the train, where every guest was provided with specially banded cigars, cigarettes in specially labeled packs, candy, souvenirs and informative literature prepared for the occasion. A hot buffet luncheon was served in the turbine room of the Susquehanna River station, ice cream and coffee on the train, and dinner in five dining cars added to the train after leaving Reading.

The companies that conducted the inspection trip have received many complimentary letters from the Rotary, Kiwanis and other civic clubs, chambers of commerce, city and borough officials, manufacturers, merchants, bankers and other individuals who made the trip.

Attractive Office Signs for Utilities

BY M. L. WILSON
Lighting Division, Commercial Department, Alabama Power Company

A NEW standard electric sign has been adopted by the Alabama Power Company for its offices located in the towns served by the company. The sign, as illustrated herewith, marks a distinct departure in sign manufacture and is designed with interior lamps providing a fine advertising display, and with exterior border lamps furnishing illumination to brighten the store front and street. The sign is now being installed in the Selma, Anniston, Montgomery and Tuscaloosa offices.

Its dimensions are 8½ ft. long by 5 ft. high and in addition to the words "Alabama Power Company" it bears a conventionalized design of one of the company's 110,000-volt transmission towers in illuminated glass. Reproducing the tower in crisscross bars of raised glass was something the sign manufacturers had never attempted, but the idea was executed with pleasing effect.

The sign is double faced and contains eighty-four 50-watt lamps, forty-eight back of the letters and towers and thirty-six on the edges in an exposed lamp border. Each of the 50-watt lamps will be equipped with a suitable diffusing globe, and the border will have a high-speed chasing effect. The letters and tower are set off against a background finished in statuary bronze.

UTILITY OFFICE SIGN DEPICTS TRANSMISSION TOWER IN RAISED GLASS

Pipe-Thawing Rates Approved

THE Public Service Commission of New York has approved a schedule, effective Jan. 15, of the Adirondack Power & Light Corporation for thawing out water pipes in the Bolton, Lake George, Schroon and Whitehall districts which includes the use of electrical energy, of special equipment and special services of the company's employees. The rate is $10 for the first hour's use, and $5 for each additional hour, with 50 per cent overcharge to cover Sundays and holidays and for calls made outside of standard working hours.

A GROUP OF CUSTOMERS ON INSPECTION TOUR OF THE SUSQUEHANNA RIVER STATION

Digest of Electrical Literature

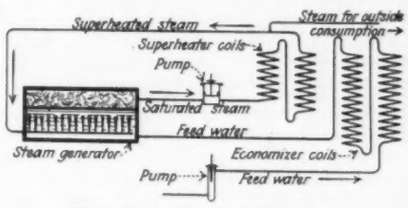
Generation, Control, Switching and Protection

Carrying Capacity of 60-Cycle Buses for Heavy Currents.—TITUS G. LE CLAIR.—The increasing use of large blocks of power at low voltage in restricted spaces has led to the need of designing buses for very heavy currents. Magnitudes of the order of 10,000 amp. are to be anticipated in the near future; in fact, this figure has already been exceeded in certain electric furnace installations. For simple designs formulas have been developed from which the carrying capacities can be calculated. These designs, are, however, not easily mounted. Those which can be easily constructed are difficult of computation, because the current distribution is affected not only by the skin effect of the bus itself but also by the "proximity effect" of the other phases. The latter tends, in a hollow arrangement of the buses of a three-phase system, to draw the currents toward the center of the figure, so that the current density at the edge of a bar of a built-up bus may be several times that at the middle. To secure data for the design of such buses tests have been made for a number of simple arrangements, from which the dimensions for capacities up to 10,000 amp. have been determined on the basis of a 30-deg. temperature rise. —*Journal A.I.E.E.*, January, 1926.

Hydro-Electric Development and Steam Equipment

20,000-*Kva. Generator.*—G. LEWINNECK.—Two of the main generators of the Bavarian Walchensee plant have a capacity of 20,000 kva. each and represent the largest hydro-electric units installed in Europe. Many unusual features in the design of these large machines are brought out in this paper. They are driven by horizontal-shaft Francis turbines at a speed of 500 r.p.m. The rotor with its salient poles, weighing 86 tons, has withstood a speed of 900 r.p.m. without exceeding the elastic limit of the material. It is made of fourteen heavy disks of Siemens-Martin steel heat-shrunk on the shaft. Laminated and properly transposed copper bars, two in each slot, constitute the 6,600-volt winding of the three-phase stator. A very rugged coil-end bracing insures ample mechanical resistance against dynamic displacement under short-circuit stresses. The generators are completely inclosed and are ventilated by two rotor fans. Special forced oil and water cooling was provided for the main bearings. The main exciter, which in turn carries its own exciter dynamo, is mounted flying on the outer shaft end. Between waterwheel and dynamo is placed a brake disk to which a number of compressed air operated brake shoes can be applied to stop the set quickly in case of emergency. The generator weighs complete 142 tons and reaches at unity power factor an efficiency of 97 per cent at full load.—*A.E.G. Progress, November*, 1925.

Steam at 1,500 lb. from a Fireless Boiler.—To avoid the difficulties of building a high-pressure boiler in which the heat for evaporating the water must pass through metal walls, Prof. Dr. Löffler of Charlottenburg, Germany, has devised a novel type of boiler in which the heat is supplied by steam forced through the water. The arrangement is shown diagrammatically in the figure. The oil-fired setting contains superheater and economizer only. A motor-driven pump forces steam through the superheater to the steam generator, where it bubbles up through the water and generates additional steam, which is returned by the pump to the superheater. Any desired pressure can be



FIRELESS STEAM GENERATOR

built up. Steam for outside consumption is drawn off beyond the superheater outlet. The construction of the boiler is described, and it evidently is vastly cheaper than one of the directly fired type would be. This advantage disappears with lower pressures, so that the idea is applicable economically only to very high pressures. Tests with an experimental plant point toward the practicability of the scheme.—*Power*, Dec. 29, 1925; from *Zeitschrift des V.D.I.*

Transmission, Substations and Distribution

Transmission Systems with Overcompounded Voltages.—H. B. DWIGHT. —A brief discussion of the advantages and disadvantages of overcompounding a transmission line and of the conditions under which it is feasible is followed by an analysis in which equations are derived for two cases—with overcompounded generator voltage and constant receiver voltage and with overcompounded voltage at both generator and receiver. In the former the diagram is a circle, in the latter it is an ellipse. The application of the equations is shown by numerical examples.—*Journal A.I.E.E.*, January, 1926.

Predetermination of Self-Cooled, Oil-Immersed Transformer Temperatures Before Conditions Are Constant.—W. H. COONEY.—The temperature rises of dynamo electric machines, in changing from one steady thermal state to another, follow an exponential law of the form $1-\epsilon^{-\beta t}$, where $1/\beta$ is the thermal time constant or the time required to attain 63.2 per cent of the final rise. It is shown here that while the winding temperature rise over room temperature of self-cooled, oil-immersed transformers follows this law only after a certain time has elapsed, quite accurate results may be obtained by calculating separately the time-temperature curves of the top oil rise above room and the winding rise above top oil, since each follows the exponential function quite closely, and then adding them together. The manner of computing the time constant is explained and an illustrative problem is worked out. It is shown that results by computation check closely with those obtained by test.—*Journal A.I.E.E.*, December, 1925.

Units, Measurements and Instruments

High-Temperature Thermometer Using Electrically Fused Quartz.—The article on "Producing Clear Fused Quartz," to which reference is made elsewhere in the Digest, describes a method whereby the range of thermometers of the liquid-in-glass type is greatly extended. The pressure developed limits the use of mercury to temperatures not exceeding 500 deg. C. The hysteresis of glass renders the indications somewhat unreliable with that material when it is subjected to such temperatures. By employing gallium in clear quartz the range from 500 deg. C. to 1,000 deg. C. is covered in a highly satisfactory manner. The boiling point of gallium is estimated at from 1,500 deg. C. to 2,000 deg. C. Its vapor pressure is very low, and it remains liquid down to 20 deg. C, though the freezing point of the pure metal is 29.7 deg. C. Quartz can safely be heated to 1,000 deg. C. and shows no lag when cooled to zero.—*Chemical and Metallurgical Engineering*, December, 1925.

Dielectric Absorption in Fibrous Insulating Materials.—R. E. MARBURY and E. R. LE GHAIT.—The preceding installment included a description of the dielectric lag meter. Some results of studies with the aid of this instrument are now given. From theoretical considerations an equation was developed for the residual voltage, at any times after discharge, of an assumed combination of pure capacity and resistance. Experimental results checked well with those as computed. Tests of an unimpregnated paper condenser showed that the curve of residual voltage rises after discharge somewhat like a saturation curve, the actual magnitudes depending upon the duration of charge and discharge. From measurements on impregnated condensers it is concluded that the saturating shape of the curves of residual voltage against applied voltage is the more pronounced: (1) the less viscous the impregnating medium (for papers impregnated with wax or paraffine the curve is a straight line); (2) the greater the difference between the specific inductive capacities of the paper and the impregnating medium; (3) the smaller the porosity of the paper; (4) the coarser the structure of the dielectric; (5) the thinner the dielectric. Other studies were made to determine the effect of moisture in the dielectric, of which the influence seems to be predominant, especially in

the production of the phenomena related to 60-cycle losses. The studies indicate that no definite test ratio can be established between direct current and alternating current. — *Electric Journal*, December, 1925.

Motors and Control

Motor-Band Losses.—T. SPOONER.—In the case of direct-current railway motors it is almost universal practice, in this country at least, to hold the rotor windings in the slots by means of wire bands. The assumption often made that the losses due to these bands are negligible is shown to be not necessarily true; they are actually of appreciable magnitude, sometimes sufficiently large to be detrimental to the cooling of the machine. By tests of a small machine checked against a large one the band losses are found to vary according to the 1.7 power of the frequency and from the 1.35 to the 1.8 power of the induction, depending on the width and type of band. These losses are shown to be due chiefly to the change in the radial component of the flux as the band passes by the pole tip. For average bands about 15 per cent of the losses (hysteresis and eddy) are due to the tangential flux in the bands. A typical set of curves is shown for calculating band losses, which, in large railway motors, may under certain conditions amount to 2 kw. or 3 kw.—*Journal of A.I.E.E.*, January, 1926.

Heat Applications and Material Handling

Producing Clear Fused Quartz Electrothermally.—EDWARD R. BERRY.—When quartz is melted in the air, the water and dissolved gases that crystallized out with the quartz millions of years ago are set free and manifest themselves in the form of microscopic bubbles. The presence of these bubbles makes the product translucent rather than transparent. By fusing it in vacuo they expand and most of them force themselves to the surface through the viscous mass. The few that remain are then greatly diminished in volume by allowing nitrogen or other gas to flow into the container while the quartz is still molten until pressures well over 1,000 lb. per square inch are obtained. The process involves serious difficulties, but results in a transparent material that can successfully be made into tubing and rods. One of its important uses is in thermometers; by using gallium as the liquid an accurate instrument results, covering the gap between 500 deg. C. and 1,000 deg. C. in a remarkably satisfactory manner. —*Chemical and Metallurgical Engineering*, December, 1925.

Electrified Open-Pit Iron Mining on the Mesabi Range.—A series of six illustrations depicts the use of 350-ton shovels and draglines and other heavy equipment.—*Engineering and Mining Journal-Press*, Dec. 26, 1925.

Arc Welding as a Manufacturing Process.—H. M. HOBART and W. SPARAGEN.—This paper contains suggestions on the choice of material for structures or products that are to be welded and gives data on the properties of welded joints, the welding wire to be used and the speed attainable. Since the speed in feet per hour is dependent on many factors, it is preferable to express it in terms of metal deposited per hour, which is a fairly definite quantity and under ordinary conditions is about 1 lb. for hand welding. Automatic machines working on long seams in $\frac{3}{8}$-in. and $\frac{1}{4}$-in. plates have been welded at 15 ft. and 12½ ft. per hour, consuming 6½ lb. of welding wire.—*General Electric Review*, December, 1925.

Traction

Oil-Electric Versus Steam Locomotives.—W. W. BAXTER.—Data have been compiled on the operation of a 60-ton oil-electric locomotive for the period from June, 1924, to Sept, 13, 1925, during which time it was in service on fifteen various roads. With one exception, the cost in cents per mile ranges from 13.9 to 23.9; per locomotive hour most of the figures lie not far from 35 cents with extremes of 19.8 and 62.8. This locomotive was built primarily for switching service. Recently, also, comparative tests were made by the Long Island Railroad on an oil-electric and a steam locomotive. From the data presented the following are abstracted:

Items	Oil-Electric	Steam
Total cars handled	1,124	1,351
Total hours of test	56	70
Actual working time	48¼	60
COSTS:		
Fuel—224 gal. oil, at $0.05½	$12.32	.....
19.09 tons, at $5.384	.....	$102.46
Water—48 cu.ft. at $0.08 per 100	0.038	.....
3,757 cu.ft., at $0.08 per 100	.....	3.016
Diesel lubricating oil—30 gal., at $0.60	18.00	.....
Engine oil—1 pt., at $0.14½	0.148	.....
—4 pt., at $0.14½	.....	0.59
Valve oil—2½ pt., at $0.25¼	.....	0.644
Total	$30.506	$106.71

From these and other tests the conclusion is reached that the cost of operating oil-electrics is only about a third as great as that for steam locomotives. —*Railway Review*, Dec. 12, 1925.

Auxiliary Devices on B.-M. T. Articulated Cars. — CLARENCE W. SQUIER. — Battery-charging equipment which prevents overcharging, inclosed heating elements, safety switches and the use of 40-watt, 30-volt lamps connected twenty in series are some of the features described in this fifth article of a series on the new Brooklyn-Manhattan Transit cars.—*Electric Railway Journal*, Dec. 26, 1925.

Java State Railway Electrification.—J. RALPH JOHNSON.—The newly electrified section comprises 32 track-miles of suburban line and is operated at 1,500 volts direct-current. This represents the initial stage of a comprehensive scheme, for it is proposed to electrify a large portion of the state railways, comprising about 1,600 miles, during the next few years. The total lack of coal in Java and the existence of several water-power sites in the vicinity of the railroads makes this plan attractive. The present article describes the sub-stations, overhead construction, track and rolling stock, with illustrations.—*General Electric Review*, December, 1925.

Telegraphy, Telephony, Radio and Signals

Powdered-Iron Cores. — W. EHLERS. —The paper describes the development of the Pupin and Krarup ideas of reducing eddy currents and hysteresis losses in iron cores for weak current work, as, for example, in loading coils for telephone cables. A review is given of modern methods of manufacturing powdered-iron cores on a large scale. It is stated that the production of a good core of this type is not so much a question of finding a suitable iron as of employing an insulating material which flows readily and uniformly into the interstices between the iron particles and which there provides an insulating film even under the exceedingly high pressures which are used to compress the powder mixture. Several curves accompanying the paper illustrate the magnetical properties of the most modern types of powdered-iron cores for Pupin coils. — *A.E.G. Progress*, November, 1925.

Wireless Signal Variations.—E. V. APPLETON and M. A. F. BARNETT.—The existence of an upper ionized layer, the so-called "Heaviside layer," has been questioned and positive experimental evidence is still lacking. The present authors have previously made a study of fading and, by measuring the variations in intensity of received signals when the frequency of the short-wave transmitter was continuously varied over a small range, have shown that the phenomenon is due to the existence of two or more rays, but this is not convincing evidence that one of the rays necessarily comes from the upper atmosphere. They now propose a method of measuring the angle at the ground of the incident ray, which involves the simultaneous use of an aërial and a loop antenna. The theory of this method is given. Experiments carried out at Cambridge on the London signals indicated an angle of about 70 degrees with the horizontal. The method involves difficulties of which a discussion is included.—*Electrician (England)*, Dec. 11, 1925.

Miscellaneous

Automatic Pumping Plants. — K. TRÜRLEMANN.—The supply of isolated farms or small settlements with water under pressure does not, as a rule, warrant a permanent attendant for the pumping plant. Electrically driven pumping sets for such purposes are therefore arranged to operate automatically. Answering diversified operating conditions, installations of this nature become sometimes quite complex, particularly when they involve safety features affecting the water supply and the electric drive. Further complications are added when advantage is taken of off-peak energy rates for the refilling of the water tower. Among a number of representative installations, the author describes in this practical paper the best solutions found for various of the above-mentioned working conditions. For each example a complete wiring diagram is given.—*Brown-Boveri Mitteilungen*, December, 1925.

News of the Industry

East Pool Takes New Steps

New England Power Association Formed —Maryland Charter Granted to the Northeastern Power Association

THE reorganization plan of the New England Power Company, calling for an issue of $20,000,000 new capital for the acquisition of new plant and property (see ELECTRICAL WORLD, Oct. 17, page 811, and Nov. 28, page 1118), was approved last Saturday by the shareholders of the company. The New England Company will be liquidated and the new organization will take the name of the New England Power Association. The new holdings are taken by F. L. Carlisle & Company, Stone & Webster, Inc., and interests affiliated with the International Paper Company. The official statement says that Stone & Webster have placed a very substantial portion of their subscriptions to the stock of the new company with the Edison Electric Illuminating Company of Boston, the Turners Falls Power & Electric Company, the United Electric Company of Springfield, the Hartford Electric Light Company, the Blackstone Valley Gas & Electric Company and others. The Narragansett Electric Lighting Company of Providence has not joined.

On Monday a charter was granted under the laws of Maryland to the Northeastern Power Corporation, in which are interested the New England associated companies, the Power Corporation of New York, the Mohawk & Hudson Power Corporation, the Buffalo, Niagara & Eastern Power Corporation and the International Securities Company. The new company, which for purposes of taxation the Maryland Tax Commission ranks as a five-hundred-and-fifty-million-dollar corporation, is capitalized at 250,000 shares of preferred stock, 250,000 shares of no-par class A stock and 5,000,000 shares of common. Control, it is understood, will be held by the Carlisle group and the Schoellkopf interests of Buffalo.

Pacific Gas & Electric to Spend $25,000,000

Plans of the Pacific Gas & Electric Company for 1926 call for the expenditure of $25,000,000 for improvements, according to F. A. Leach, Jr., vice-president and general manager. Among the larger jobs and the amounts to be spent are: Pit 4 dam and intake, $1,740,000 of the total of $15,000,000 which the completed plant will cost; Melones power house and tunnel, $2,523,000; service improvements in the San José district, $750,000; Manteca - Salinas transmission line, $598,000; continuation of work of raising Fordyce dam, $400,000; Manteca substation, $193,000; Drum canal and Spaulding tunnel, $200,000; Hayward substation, $193,000; Redwood City substation, $128,000; San Mateo substation, $165,000, and Salinas substation, $128,000.

The work of building and equipping the new power house of 36,000 hp. capacity at Melones, on the Stanislaus River, will be virtually completed during the year. The 220,000-volt transmission line from the Vaca-Dixon substation to the new Contra Costa substation near Antioch, Cal., is now under construction and will be completed by the middle of the year. This is a double-circuit line 15 miles long and will cost nearly a million dollars.

Heflin Takes a Hand on Muscle Shoals

Alabama Senator Strives in Vain to Expedite Committee Proceedings and Comes to Defense of Alabama Power Company— Public Attitude Undergoing Change

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

EARLY consideration of the House resolution on Muscle Shoals can hardly be bestowed, Senator Norris said on Tuesday. So many matters are crowding upon the agricultural committee, to which the resolution was committed, that he, as chairman, thinks five or six weeks may elapse before disposition of it can be made.

Insistent efforts were made at the Tuesday meeting of the committee by Senator Heflin of Alabama to obtain action on the resolution, which provides for a joint congressional committee to receive bids for the Muscle Shoals properties. Senator Norris said it would require more time to dispose of the resolution than the committee could give at present. It is expected that the Senate committee will eliminate the reference to the Ford offer but it is thought likely to approve the proposal otherwise.

In the meantime Senator Smith of South Carolina has come forward with a proposal that seems to appeal to many members of the Upper House. He suggests that nothing be done with Muscle Shoals until more is known about the commercial possibilities of the processes of nitrogen fixation. He would have the government conduct experiments at Muscle Shoals, allowing the surplus power go into distribution in the Southwest. The returns from the sale of the power would be used to finance the large-scale experiments, which would be conducted by a commission to be appointed by the Secretaries of War and Agriculture. Secretary Hoover, appearing again before the House committee investigating foreign monopolies, said some definite action should be taken as to nitrogen production at Muscle Shoals, as the uncertainty is retarding the development of nitrogen fixation by private interests. Since the Smith proposal offers middle ground between the Norris plan for government operation and the other extreme of turning the properties over to a single bidder, it would seem to have a fair chance to get through the Senate.

Representative Morin, chairman of the committee on military affairs of the House of Representatives, declares in a formal statement relating to other bills now before it that if the Muscle Shoals situation does not receive early consideration by the Senate it will be in the interest of the public welfare to take up and report to the House at once suitable legislation settling this problem.

Tennessee River Hearing Indicates Changed Viewpoints

The hearings on the Norris resolution proposing to take the Tennessee River out from under the water-power act were concluded on Tuesday. Leonard H. Davis of the Union Carbide Company appeared to support the resolution. He explained that the Union Carbide Company had been a bidder for Muscle Shoals and expected to submit another bid for the properties. For that reason, he said, his company is interested in seeing the developments on the Upper Tennessee co-ordinated with that at Muscle Shoals. He suggested that the resolution should apply to preliminary permits as well as to licenses. Senator Norris agreed to make that change in his resolution.

One of the outstanding features of the hearing has been the testimony showing the loss of confidence in the ability of Congress to deal effectively with business propositions as a result of the long delay in agreeing on a policy for the disposition of Muscle Shoals. Witnesses from Asheville and western North Carolina pointed out the acute need for more power and protested vigorously against interference with the plans of private enterprise. They were interested particularly in preventing any delay in the granting of rights to the Pigeon River Power Company. Julius Martin, the attorney for that company, told the committee that it had expended $450,000 in the purchase of land and in making surveys to comply with the terms of the preliminary permit. Senator Norris said that he was willing to exempt the companies that actually have expended money in perfecting their rights.

The Nebraska Senator, during the course of the hearing, referred to Ala-

bama as being in the grasp of the Alabama Power Company. This brought the prompt rejoinder from Senator Heflin that he had received no complaints against the Alabama Power Company and its rates, as fixed by the Public Service Commission of the state. Significance is attached to the defense of the Alabama Power Company by Senator Heflin, a former critic. It is thought to reflect the changed public attitude in the South toward power companies.

New Jersey Governor Decries State Regulation

In his inaugural address at Trenton this week Governor A. Harry Moore of New Jersey, advocating a tri-state board, representing New Jersey, New York and Pennsylvania, to acquire anthracite-coal mines and compete with the private operators, opposed Governor Pinchot's plan of making the anthracite industry a public utility. In this connection Governor Moore said:

"The plan to classify the business as a public utility and subject to regulation is impracticable. The policy of regulation has completely failed to secure reasonable rates to our people for public utility service, such as transportation, telephone and electric light rates, and there is no ground for belief that it will succeed in this connection."

New Mexico Men Will Hold a Convention Next Month

The annual convention of the New Mexico Electrical Association will be held Feb. 15 to 17 at the Franciscan Hotel, Albuquerque, according to Bernard L. Wiles of the Albuquerque Gas & Electric Company, who is the secretary. Delegations from Texas, Arizona and Colorado will attend, and Arthur Prager, general manager of the Albuquerque company and former president of the association, is now in Colorado developing interest in the meeting.

Irrigation Interests Intervene in Edison-Herminghaus Case

Irrigation interests representing 94 per cent of irrigated lands in California have filed briefs with the State Supreme Court demanding rejection of the appealed Herminghaus injunction, which prevents the Southern California Edison Company from storing riparian water. In the Superior Court of Fresno County (see ELECTRICAL WORLD for March 7, 1925, page 526) a decision was handed down enjoining the power company from storing water in Huntington Lake on its Big Creek hydroelectric project, except that which is produced by the run-off in the Huntington Lake basin.

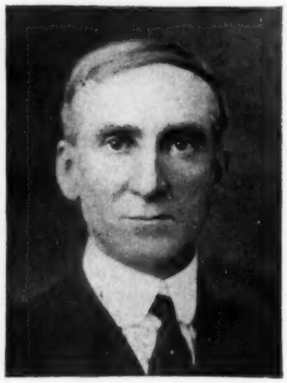
The briefs filed by the irrigationists with the Supreme Court, which is now hearing the suit, say that the case involves only 6 per cent of the state's lands and that if either party wins in the Supreme Court the right to water of approximately half of the remaining lands will be jeopardized or destroyed. Joining in the briefs against both parties are the United States Reclamation Bureau and the State of California.

To Push New Department

American Engineering Council at Washington Meeting Takes Firm Stand for Cabinet Reorganization

OUTSTANDING in the proceedings of the American Engineering Council at its Washington meeting on Jan. 13-15 was the indorsement of a movement to abolish the Department of the Interior and create a new Department of Public Works and Domain. Identic bills will be introduced in both houses of Congress favoring this plan.

At a national public works conference held under the auspices of the A. E. C. and attended by delegates from more than 70 national and local engineering organizations William McClellan, former president of the American Institute of Electrical Engineers, who presided, announced that committees of engineers to arouse popular interest in the undertaking would be formed in thirty-six states, which were



DEXTER S. KIMBALL

being organized by counties. He said five thousand engineers had been enrolled and would immediately begin a campaign of education in alliance with more than one hundred allied organizations representing science, labor, architecture, construction, chemistry and municipal improvement.

Fearing failure of the proposal pending in Congress to establish a reorganization board upon advice of which the President might make transfers of bureaus, divisions, commissions and boards by executive order, the American Engineering Council has decided to press independent action, said Gardner S. Williams of Ann Arbor, Mich., chairman of the public works committee.

Besides its championship of government reorganization, the council officially adopted as part of its program of endeavor in the immediate future research in many fields of industrial and human effort, solution of the nation's traffic problems, reforestation, development of national water-power resources, elimination of waste, protection of the sources of power and a more thorough organization of engineers to act in the public interest.

Dexter S. Kimball, dean of the College of Engineering, Cornell University, and former president of the American Society of Mechanical Engineers, was made president of the American Engineering Council in succession to former Governor James Hartness of Vermont. G. S. Williams of Ann Arbor, Mich., and I. E. Moultrop of Boston were named vice-presidents, Mr. Williams being re-elected.

Wisconsin Commission Gives Hearing on Rural Contract

A contract for rural electric service based on an extremely careful study of desirable economic relations with utility customers was the subject of a public hearing before the Railroad Commission of Wisconsin at Madison on Jan. 22. The proposed contract was submitted by the Wisconsin Power & Light Company, of which G. C. Neff is vice-president and general manager. Owing to Mr. Neff's activity in the N. E. L. A. committee on rural service and in the National Committee on the Relation of Electricity to Agriculture, especial importance is attached to the proposed contract.

In general, the contract embodies these stipulations: (1) Construction, operation, maintenance and financial ownership by the utility of the rural extension, including service and meter; (2) financing of extension by the utility up to an average of $400 per customer; (3) a flat monthly service charge dependent on transformer capacity required; (4) a low two-step energy rate; (5) option to customer of (a) buying electrical equipment, exclusive of wiring and installation, of a value approximating utility's average investment per customer, or a total wattage of at least 4,000, or (b) using not less than 1,200 kw.-hr. per year during second and subsequent years; (6) permission of customer to erect lines on adjacent highway; (7) a five-year agreement with subsequent year-to-year renewal unless terminated by customer; (8) cancellation of service charges for no period exceeding three months when premises are unoccupied owing to change of tenancy.

Accompanying the contract are some explanatory remarks or rules which clarify many points that have been the subject of debate heretofore. They cover: (1) Intent; (2) definition of rural customer; (3) definition of rural extension; (4) cost of extension; (5) analysis of extension; (6) payments by customers; (7) additional customers; (8) combined rural extension and transmission line; (9) customer's investment in equipment; (10) rate; (11) two or more services from same transformer; (12) public buildings on rural extensions; (13) rural residence service; (14) new customers on old extensions; (15) continuity of service; (16) change of tenancy; (17) urban rules; (18) type of service; (19) extensions from high-voltage lines; (20) inspection of installations; (21) rates for villages excluded; (22) substitution of rates.

The intent of the rules indicates the spirit which motivated the drafting of the contract. It is "to facilitate the securing of electric service in rural communities on such a basis as will stimulate the widespread use of electricity for heat, light and power. In interpreting these rules, a rural extension should, so far as is practicable, be considered a community enterprise from which each individual customer will derive benefit through co-operation with all the other customers."

Handicaps of Maine Law

Kelly Says Non-Exportation of Energy Injures Proper Development of Power Market

SPEAKING recently before an audience of prominent business men in Portland, Me., Colonel William Kelly, director of engineering for the National Electric Light Association and former chief engineer of the Federal Power Commission, asserted that the Maine law prohibiting hydro-electric power exportation impedes free trade between states and delays development of valuable resources, injuring the economic welfare of the people and leading to actual shutdowns of industrial establishments in times of drought. Mr. Kelly concluded his address as follows:

"The report of the Maine Public Utility Commission in 1918 shows that the undeveloped water powers of Maine cannot be economically developed except on a large scale—far too large for the present market within the state. They doubtless can be economically developed, however, if the present prohibitive law is rescinded so that the local market can be supplemented at the start by the market in adjoining states. There have been several instances in recent years where extreme drought has reduced water levels to such an extent as to cripple electric service and shut down industries in Maine. If transmission lines had connected Maine's system with utilities in New Hampshire and Massachusetts, power could have been readily obtained from the 'New England pool.' If electricity cannot leave the state, it cannot enter it and these benefits of interconnection are lost.

"Maine has recently voted to exempt the proposed Pasamaquoddy Bay development from the prohibitive law. The Pasamaquoddy development differs in no essential respect from other Maine water powers, and it seems certain that just as soon as the citizens of Maine appreciate that fact they will take action to make possible the development of their other undeveloped water powers and at the same time remove a possible source of conflict in interstate relations."

New York Commission Favors Consolidations

In its regular report, just submitted to the Legislature, the New York Public Service Commission says:

"Consolidations and extensions of electric plants have continued throughout the past year. As stated in the report of the commission for last year, such consolidations have invariably been followed by an improved character of service and quite frequently by immediate reductions in rates or readjustments which have operated to the benefit of the public. The construction of high-tension transmission-line extensions continues at a rapid rate, providing a possible means for ultimate interconnection of substantially all of the major electric systems now in existence."

The commission condemns step rates and wholesale discounts, both of which it is rapidly eliminating; recommends legislation placing submetering under proper supervision and praises "the almost universal adoption of a form of rural rate which eliminates the necessity for the customer sharing in the expense of the cost of construction." Within a few years, the commission asserts, every farmer within the state who can reasonably afford to have electricity will be equipped.

In 1925, the commission says, 54 companies filed schedules of voluntarily reduced rates, the reductions in most cases being substantial.

Skagit and Toutle Undertakings in Washington

Authorizing a project that calls for the expenditure of more than $3,000,000, the Washington State Supervisor of Hydraulics has issued a temporary permit for water-power rights on the Toutle River, in the southwest part of the state, to R. W. Lincoln of Portland, who represents the Spirit Lake Railway & Power Company.

The city of Seattle last week filed applications for the appropriation of 3,500 sec.-ft. of water from the Skagit River and its tributaries at all points above Diablo Canyon, in eastern Whatcom County. Work is to go forward not later than Jan. 1, 1928, and will occupy three years or more. The plans include a reservoir with a dam 350 ft. high and 800 ft. long at the top, tapering to 100 ft. at the bottom. A total of 120,000 continuous electrical horsepower will be generated, according to the city authorities. The reservoir, to be fed by the Skagit River, Ruby Creek and Thunder Creek, will store 90,000 acre-ft. of water and will submerge 700 acres of land. There will be a fall of approximately 300 ft.

Many More Purchases and Mergers

This Week's Grist Includes Transactions in Wisconsin, Iowa, Kentucky, Ohio, North Dakota, New York, Virginia, Georgia, Texas and Five Other States

FOUR electric companies which have been operated as subsidiaries of the Wisconsin Public Service Corporation have been consolidated with the main system. They are the Northeastern Power Cimpany, the water-power construction organization; the Northern Heat, Light & Power Company, serving five villages; the Wabeno Lighting Company, serving Wabeno, and the Denmark Light & Power Company, serving Denmark.

The Beloit Water, Gas & Electric Company, acquired last year by the Insull interests, as a subsidiary of the Northwest Utilities Company, has been taken over by the Wisconsin Power & Light Company, also a Northwest Utilities Company subsidiary, thus becoming part of the general system of the purchasing company. It will, however, retain its name as an operating property.

The Galva (Iowa) municipal light plant has been transferred to the Iowa Light, Heat & Power Company, for a consideration of $25,000. Galva will now be supplied from Sioux City. By a vote of 226 to 76 Schaller, Iowa, has voted to sell its municipal lighting plant to the Sac County Electric Company of Sac City.

The Central States Power & Light Corporation, with headquarters at Davenport, Iowa, has completed the consolidation of properties it has acquired in Arkansas and Missouri. These include the Arkansas Public Service Company, serving Berryville and other places; the Southeast Missouri Public Service Company and a controlling interest in the Missouri Electric Power Company and the Missouri Power Development Company. Cities served by the Missouri properties are Ste. Genevieve, Marshfield, Mansfield, Ava, Willow Springs, Cabool, Sullivan, Mountain Grove and Doniphan. The Central States Power & Light Corporation is making plans to spend more than one million dollars in connecting these properties and to improve power plants.

The Illinois Public Utilities Company, which has district offices in Lincoln, Ill., has acquired the Atlanta Electric Light & Power Company, serving Atlanta, McLean and Lawndale, Ill. This brings its total of Illinois plants to 25.

The Kentucky Utilities Company has made an agreement with the West Kentucky Coal Company to purchase all the capital stock of the West Kentucky Electric Power Company, which has a 9,000-hp. plant at Earlington and extensive transmission and distribution systems.

Plants serving Lewisport, Hawesville, Cloverport and Hardinsburg, all in Kentucky, have been acquired by the Ohio River Power Company and will be connected with its recently purchased plant at Cannelton, Ind.

The Ohio Public Utilities Commission has authorized the Suburban Power Company to acquire ten electric properties in the district around Columbus, Findlay, Zanesville and Newark, Ohio. These properties and the purchase prices are: Van Lue Electric Light Company, $20,000; Big Walnut Electric Company, Sunbury, $31,000; Payne Light & Power Service Company and Payne & McComb Light & Power Service Company, McComb, $70,000; Evans Light & Power Company, Frazeysburg, $9,000; Bloomville Electric Company, $50,000; Commonwealth Power Company, which supplies Gambier, Danville, Buckeye City and North Canton, $92,000; Midwest Power Company, Utica, $72,000; Dresden Illuminating Company, $25,000, and Hancock Light & Power Company, operating at Jenera and Benton Ridge, $26,500.

The Cleveland Electric Illuminating Company has purchased the Cleveland, Painesville & Eastern Railroad Company, and included in the purchase are the electric light and power properties of the United Light & Power Company of Geneva, Ohio, a subsidiary of the purchased company. The acquired properties serve about 7,000 consumers.

Besides the acquisition, previously announced, of the United Power Company of Crosby, N. D., the Montana-Dakota Power Company has taken over the properties of the Eastern Montana Light & Power Company of Glendive, Mont., the Montana Utilities Company and the Williston (N. D.) Light, Heat & Power Company, in addition to the local plants at Ray and Stanley, N. D., and Scobey and Pleniwood, Mont.

The Otter Tail Power Company of Fergus Falls, Minn., has purchased the plant of the Finley (N. D.) Light & Power Company.

The New York Public Service Commission has granted to the Depew & Jamestown Light, Power & Conduit Company of Lancaster permission to take over the electric plant and system operated by Fred W. Young in western New York State for $360,000.

Acquisition of the electric plant at Tappahannock by the Virginia Electric & Power Company has been announced by President William E. Wood. Sale of the uncompleted hydro-electric plant of the defunct Valley Power Company at Grove Hill, on the Shenandoah River, has been made to the Shenandoah River Power Company.

Acquisition by the Fitkin interests of the Newport News & Hampton Railway, Gas & Electric Company of Virginia was announced this week. The property will be combined with the Virginia Western Power Company, the Virginia Northern Power Company and other Virginia holdings as a subsidiary of the National Public Service Corporation, the Fitkin utility holding company.

The electors of Littleton, N. C., have voted to sell the municipal electric lighting and power plant to the Carolina Power & Light Company of Raleigh. The price is given as $40,000.

The Bainbridge Power Company, serving Bainbridge, Donaldsville and other places in Georgia, has been purchased by the newly organized Georgia-Florida Power Company. The Bainbridge company owns a hydro-electric plant and a steam-reserve plant and leases transmission lines. Its property is valued at $400,000.

The Cameron (Tex.) Water, Power & Light Company has sold its properties to the Texas Power & Light Company, it is announced by T. S. Henderson, president of the Cameron company. A 60,000-volt transmission line is to be built from Temple to Cameron.

The Sulphur Springs (Tex.) Electric Light & Power Company's plant, formerly owned by Ashcroft & Sons, has been purchased by the Texas Power & Light Company of Dallas and will be consolidated with other properties of the Texas Public Utilities Company, according to announcement by C. E. Calder, president of the purchasing concern.

The Western Public Service Company has purchased the electric power and light plant at Madisonville, Tex.

The West Texas Utility Company of Abilene, Tex., has purchased the electric light plant at Junction, Tex.

The electric light and power system at Fairfax, Okla., operated and owned by C. I. Huffaker, has been sold to the Electric Public Service Company, composed of Ohio and Eastern capitalists.

The Suburban Light & Power Company of Aurora, Col., has been sold to the Public Service Company of Colorado, which for some time had supplied it with electricity at wholesale rates.

Residence Load Chief Topic of N.E.L.A. Commercial Men

Merchandising and the opportunities for the improvement of load factor through the exercise of more discrimination in sales activities were the topics of chief interest in the concluding sessions of the midwinter meeting of the N. E. L. A. Commercial Section executive and national committees held last week at the Edgewater Beach Hotel, Chicago. The emphasis was on the residence market, and Chairman T. L. Phillips of the merchandising committee outlined plans for a thorough presentation of the subject before the national convention next spring. This presentation will embrace the five fundamentals of market building: (1) knowledge of the market through adequate statistics; (2) constructive sales policy; (3) skillful and intelligent buying; (4) efficient management and operation, and (5) effective selling methods. E. W. Lloyd, chairman of the section, reported a preliminary statistical survey of 300 central stations, showing an average annual residence consumption of only 362 kw.-hr., although in some cases it runs as high as 1,200, 1,440 and 1,650 kw.-hr. per year, indicating the possibility for general improvement.

A special committee of manufacturers that has been considering plans for co-ordinated advertising voted to call upon all manufacturers of heating devices to concentrate upon electric toasters during the month of March and upon percolators in April and to ask all central-station companies to focus their publicity and sales effort upon these appliances. The committee plans to publish a booklet on the opportunity to develop such a load.

The two-year tests on electric range load which have been conducted in Spokane and Boise by the domestic cooking and water heating committee have been completed and will be made available in a report to be issued a month in advance of the convention. Meanwhile the special instruments which have been used in the test have been ordered sent to California for a similar study on water heating. The industrial heating committee is organizing a study course as a preliminary preparation for the electric heating school which will be conducted this year at Mansfield, Ohio, by the Westinghouse company.

Under the auspices of the "how to buy" sub-committee of the merchandising committee, a dinner was given at the Hotel Sherman on Friday evening by *Electrical Merchandising* to about a hundred central-station sales managers and a small group of portable-lamp manufacturers. The dinner was followed by a discussion of buying methods. On Saturday morning these sales managers made a tour of the Chicago Furniture Mart to study how the competitive merchant buys portable lamps.

Details of E. N. Hurley Award

Rules and qualifications to govern the Edward N. Hurley award of three prizes—$5,000, $3,000 and $2,000 respectively—to the electric light and power companies making the most constructive contributions toward developing a more effective method of merchandising electrical household appliances have been adopted by a committee appointed for that purpose by the executive committee of the Commercial National Section, N.E.L.A. These rules and qualifications are:

RULES GOVERNING THE CONTEST

1. Give details of the plan to be considered as the most constructive contribution toward developing a more effective method of merchandising electrical household appliances at retail. (Note: Submitting a written plan of theoretical procedure is not sufficient. The plan must have had practical application, including at least six months' use in the year 1926.)

2. Give the volume of annual sales of household electrical appliances, in dollars, and the total number of wired homes on the company's distributing system. (Note: To what extent are sales the result of resale crews furnished or maintained wholly or in part by manufacturers, jobbers or others outside central-station organization? Give volume of sales of non-electrical merchandise.)

3. Give the net merchandising profits, based on average capital employed, as represented by average investment in merchandise, receivables, store fixtures and equipment. (Note: Include, in addition to all cost of merchandise, administrative, operating expense, advertising, occupancy charges, exchanges and servicing expense.)

4. Show the increase in kilowatt-hours sold to the average residential customer. (Note: Contestants may submit data to show a consistent policy indicating a constant increase in this average over a period of years.)

5. (a) Show the gain in public good will as a result of the merchandising policy. (b) Show the gain in trade good will in the electrical business, as well as by other retailers, as a result of merchandising policy.

QUALIFICATIONS

Contestants must be members of the National Electric Light Association.

Prizes will be awarded to companies operating in individual cities or to adjacent groups operated as one system locally.

Contestants shall have been merchandising for a period commencing on or before Jan. 1, 1925, and shall have established at least one store or display room.

The companies winning this award shall disburse the money among the employees of their respective organizations who, in their judgment, have had to do with the development of their merchandising plan and its application, and who have taken part in the preparation of the data submitted in this contest.

In general, the winning plan under this contest shall have shown a net profit, shall cover only the sale of merchandise at retail to consumers, shall have promoted or maintained public and trade good will, and be constructive in effect, for the expansion of sound merchandising, and shall have shown an increase in kilowatt-hours per average residential consumer.

All matter must be delivered at the headquarters of the National Electric Light Association on or before Feb. 1, 1927. All matter shall be inclosed in a blank, sealed envelope, which shall in turn be inclosed in an outer envelope, addressed to National Electric Light Association, 29 West Thirty-ninth Street, New York City, and shall be marked plainly "Competition for Hurley Award," with the name of the contestant plainly shown on this outside envelope, together with the address.

The written matter inclosed in the blank inner envelope must not be in any way marked so as to indicate the identity of the contestant to the judges. As this material is opened the papers will be given a number, which will identify it with the company competing and which will be ascertained by the judges only after the awards have been made.

Kentucky Utility Men Meet

Three Hundred Assemble in Optimistic Mood in Louisville for Annual Gathering of Association

FIRM belief that electrical utilities have entered upon an era of development and prosperity that will far exceed present estimates was expressed at the ninth annual meeting of the Kentucky Association of Public Utilities, held at the Brown Hotel, Louisville, on Jan. 15. Nearly 300 utility executives, department heads and women employees attended the meeting, which was devoted almost entirely to power companies' customer, public and employee relations.

In an address on "The Value of Associations to Utility Men," D. L. Gaskill of Greenville, Ohio, traced the growth of the industry over the past thirty years and maintained that had it not been for the aid of associations in the solution of problems common to all companies the utilities would now be at least ten years behind their present state of development.

President James P. Barnes, who refrained from making a presidential address, called upon Harry Reid, president Interstate Public Service Company, to outline "The Future of the State's Utilities." Mr. Reid sketched a comprehensive plan for the interconnection of existing transmission systems in Kentucky whereby the companies participating will realize material benefits because of considerable diversity in the time of peaks and nature of loads. As now conceived the plan calls for increasing some lines to 132,000 volts and the construction of new ones of that voltage. He further declared that the electric utilities not only in Kentucky but in the entire country are on the threshold of a remarkable expansion in business.

E. A. Jonas, editor-in-chief of the Louisville *Herald-Post*, addressed the meeting on "What Is Power?" Benefits to be gained by organized safety work in public utilities were discussed by Neil W. Funk of Louisville, who has found that best results are obtained through the medium of group meetings of employees and the encouragement of safety suggestions from employees, with prizes for workable ideas. Labert St. Clair, New York, advocated a continuous program of advertising so written that any patron of the utility could understand it. Dempster MacMurphy discussed the relations of public utilities with the press.

Customer relations was the subject of an address by W. H. Hodge, who deplored the promiscuous use of the word "consumer" in place of "customer." He urged particular care in the selection of employees who regularly come in contact with customers either at the application counter, in meter reading or in receiving complaints. Other addresses presented were "Public Utilities from the Citizen's Viewpoint," by George Colvin; "Water Supply from the Standpoint of the Public Utility," by W. J. Horrigan; "Woman's Work in Public Utilities," by Isabelle Davie; "Engineering Schools and Industry," by Dean B. M. Brigman, and "Kentucky's Natural Resources," by W. R. Jilson, Kentucky state geologist.

On Thursday evening, preceding the business meeting, 270 delegates and guests enjoyed an informal dinner-dance at the Brown Hotel, President Brown acting as toastmaster.

The following officers for 1926 were elected: President, T. B. Wilson, vice-president and general manager Louisville Gas & Electric Company; first vice-president, H. J. Cochrane, president Maysville Public Service Company; second vice-president, W. R. Power, general manager Ohio Valley Electric Railway Company, Huntington, W. Va.; treasurer, A. A. Tuttle (re-elected), Kentucky Utilities Company; secretary (re-elected), E. F. Kelley, Louisville Railway Company; chairman executive committee, James P. Barnes, president Louisville Railway Company.

COMPANY MANAGERS CONFER

More than a hundred district and department managers of the Kentucky Utilities Company attending the meeting took part in an annual company conference, which was held at the Brown Hotel on Thursday afternoon. L. B. Harrington, vice-president and general manager of the company, presided. Miss Helen E. Steiner of Lorain, Ohio, spoke on women's activities in utilities, and brief talks were made by Harry Reid, president of the company; John E. Davis and others.

Applications Before Federal Power Commission

An application for a preliminary permit covering the Cove Creek site on Clinch and Powell Rivers in the Tennessee Valley has been filed with the Federal Power Commission by the Union Carbide Company of Richmond, Va., a subsidiary of the Union Carbide & Carbon Company of New York. This application is in direct conflict with the application of the East Tennessee Development Company and of the Tennessee Hydro-Electric Company. The Carbide company plans call for a maximum development of this important site. It is proposed to build four dams and power houses. The head which will be obtained at the respective dams is estimated at 36, 60, 15 and 225 ft. respectively. The installation proposed at the power houses is 30,000, 50,000, 13,000 and 200,000 hp. The contention for this site will be largely a struggle to determine whether the power is to be used chiefly for industrial or for public utility purposes.

The Clarion River Power Company of Foxburg, Pa., has applied for a license covering its proposed development at two sites on the Clarion River near Clarion, Pa. One of these, known as the Mill Creek development, includes a concrete dam, creating a maximum head of 240 ft. and a reservoir extending upstream about 48 miles. The proposed installation will consist of four vertical turbines directly connected to 25,000-kw. generators, making a total installation of 100,000 kw., or about 134,000 hp. No transmission line is included in the application. The area of the reservoir will be about 10,600 acres. The power is intended for public utility use.

The Foxbury project includes a concrete dam, creating a maximum head of 156 ft. and a reservoir extending upstream about 23 miles. The installation in the power house will consist of four vertical turbines directly connected to 17,000-kw. units, making a total of 68,000 kw., or approximately 92,000 hp. The power is intended for public utility use. No transmission line is included in the application. The reservoir area will be about 2,250 acres.

H. A. Spalding, Hazard, Ky., seeks a preliminary permit for a power project in the Obey and Obed Rivers and the Big South Fork of Cumberland River, in Overton, Scott and Morgan Counties, Tenn., for public utility supply.

The Moorpark-Conejo Irrigation District, Moorpark, Cal., asks a preliminary permit for a dam with appurtenant power works in Sespe and Piru Creeks, Ventura County, Cal. The power would be applied to public utility service and irrigation.

Kennelly, Langmuir, Jewett Address Radio Engineers

The Institute of Radio Engineers held its first annual convention in New York City this week. Dr. L. W. Austin of the Bureau of Standards traced some of the causes of static interference. Dr. E. F. W. Alexanderson said that other causes and means for their elimination were alike mysteries. Dr. F. B. Jewett thought radio would eventually find its main use in conjunction with telephony. Dr. Irving Langmuir advanced the theory that radio might not be conducted by ether waves, but by corpuscular emanations. Dr. A. E. Kennelly held that the most important aspect of radio was its sociological influence. Prof. Reginald Fessenden declared that the "radio telescope" was perfectly feasible.

Premier Baldwin Out Strongly for British Electrification

Fresh impetus to the plan on which British public men and engineers have been working since the close of the war to bring about a co-ordinated and extended scheme of national electrification that will bind existing generating systems together, build new power stations and eliminate obsolete and uneconomic plants has been imparted by a speech of Stanley Baldwin, the Prime Minister, at Birmingham in which he emphatically indorsed the plan and virtually pledged the government to do everything possible to aid its speedy consummation. The work begun under Lloyd George has been followed up by the subsequent administrations, and since Premier Baldwin's accession to power experts have been steadily engaged on the task. The outcome of their study will be embodied in legislation which the Premier will introduce early in the coming session of Parliament. No details of this legislation or of any modifications or extensions of the existing scheme which the government may contemplate have been cabled to the American press, although it is asserted that the government desires to create a special control board, along the lines of the Mersey Dock Board or the Port of London Authority. This

board, if it is set up, will be managed by practical men with powers covering the whole country, for the purpose of establishing interconnecting lines and co-ordinating stations in large areas. The board will raise its own capital and work on ordinary commercial lines. After interest and sinking fund have been earned, the surplus will be applied to the reduction of the charges. Premier Baldwin believes that no government subsidy will be required, but that a government guarantee may be necessary.

American correspondents represent the people of England as having greeted Mr. Baldwin's announcement with enthusiasm and as being in the mood to close up rapidly the gap that exists between the general use of electricity in America and the comparatively backward state of the art in Great Britain. The need for fuel to carry out the program ties the project in with coal mining, and observers predict a long step forward in solving the problems of both industries.

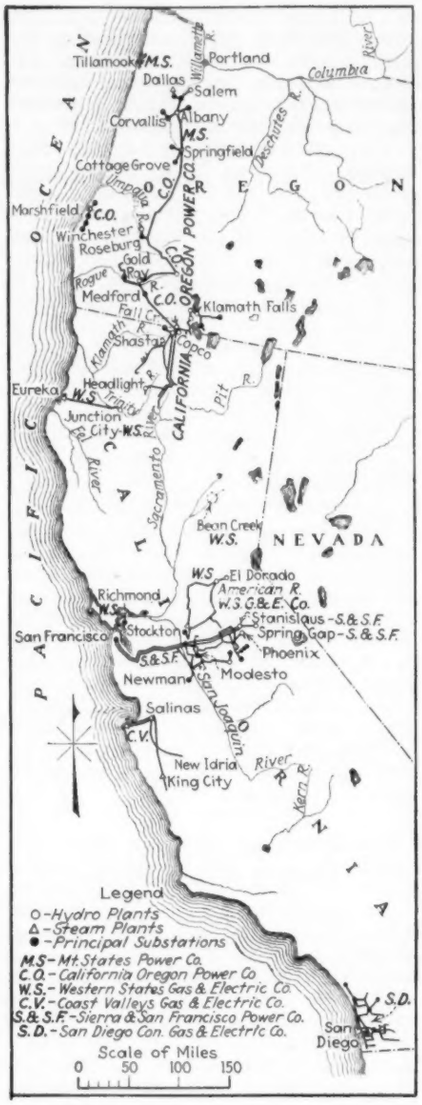
Fifteen-Year System Growth

Byllesby Output Multiplied Fourteen Times—Transmission Lines in California and Oregon

AT A RECENT conference of engineers and construction superintendents of the Byllesby Engineering & Management Corporation, of which all the capital stock is owned by the Standard Gas & Electric Company, J. J. O'Brien, president of H. M. Byllesby & Company, estimated that public utility companies directed by and affiliated with the Byllesby organization would show gross earnings of $135,000,000 for 1925. In fifteen years the number of plants owned has grown from 33 to 131, the installed capacity from 69,000 hp. to 1,400,000 hp., annual output from 210,000,000 kw.-hr. to 3,000,000,000 kw.-hr. and electric customers from 88,500 to 800,000.

The accompanying map shows the Byllesby-owned transmission systems on the Pacific Coast, including those of the California-Oregon Power Company, acquired last fall. It indicates the important relationship of the Bear Creek site on the Feather River with refference to the large interconnected Byllesby systems to the north and south. This site was recently purchased from the Feather River Power Company, and it is understood that the Byllesby company will begin construction of a 90,000-hp. plant there early in 1926, transmitting the power to Stockton at 165 kv. or higher. It would also be a comparatively easy matter, as may be seen from the map, to connect this plant with the 130-kv. line of the California-Oregon Power system, now extending about 90 miles south into California, thus making possible interchange of power between the larger Byllesby properties on the Pacific Coast.

The Byllesby lines are now tied in with the Portland Electric Power Company at Salem, Ore.; with the Pacific Gas & Electric Company at Junction City and another point about 50 miles east of that place, and also, further south, with Salinas; with the San Joaquin Light & Power Corporation at Newman, and, at the southern end of the state, with both the Southern California Edison Company and the Southern Sierras Power Company.



TRANSMISSION LINES OF BYLLESBY SYSTEM IN PACIFIC STATES

Association of Commissioners to Make Legal Inquiries

Two steps in the direction of inquiry into laws affecting the work of state public service commissions are about to be taken by the National Association of Railroad and Utilities Commissioners as an outcome of its recent convention in Washington. On the recommendation of Commissioner Adolph Kanneberg of Wisconsin a committee of the association is to collect information in all states pertaining to the various legal phases of water-power development. "So much confusion now exists," Mr. Kanneberg said recently in explaining the object of his recommendation, "that it is difficult to establish the rights of the public or the rights of the riparian owner, and as a consequence the development of water powers on many streams is being retarded. The committee when appointed will, by clearing up the law, blaze the way for the full development of entire streams in the interest of the great mass of people. With coal prices continually increasing, we, as commissioners, should do everything possible to bring into use every available and economically practicable water power."

The other step referred to is also due to a Wisconsin commissioner—Chairman Lewis E. Gettle. In accordance with a recommendation from him the national association will work out a co-operative plan with the American Bar Association and the National Conference on Uniform Laws for the establishment of uniform laws in the various states dealing with the fundamentals of utility regulation. Commissioner Gettle has been fighting for such uniform laws at two conventions. He considers the program adopted the first progressive step taken by the national association in this direction.

Wisconsin Increased Consumption of Energy 9 per Cent

Homes and industries in Wisconsin used 9 per cent more electricity in 1925 than in 1926. This increase is attributable largely to extensions made in 26 communities and to extended farm service. Electric companies added 14,000 miles of new transmission and distribution lines. During the year consolidations of public utility properties in the state eclipsed all former records. About forty companies figured in these sales, mergers and consolidations, involving an aggregate sum in excess of $40,000,000.

The Wisconsin Power & Light Company led all others in the number of privately owned and municipally owned systems that were consolidated. This company purchased two municipal systems—one at Ridgeway and the other at Dane. The largest single transaction during the year was the sale of the Wisconsin Public Service Corporation to H. M. Byllesby & Company. Other important transactions involved the sale of the Superior Water, Light & Power Company, which was purchased by the American Power & Light Company; the purchase of the Beloit Water, Gas & Electric Company by the Wisconsin Power & Light Company, and the acquisition of the Antigo Electric Company, Rhinelander Light & Power Company and Waupaca Electric Service & Railway Company by the Wisconsin Valley Electric Company.

Total production of electrical energy by Wisconsin plants in 1925 broke all previous records. An aggregate of 1,550,000,000 kw.-hr. was generated by steam and water-power plants against a total of 1,429,000,000 kw.-hr. last year. The output by steam plants was approximately 919,700,000 kw.-hr. and by hydro plants 630,300,000 kw.-hr. Water-power production fell off almost 9 per cent from the 1924 output owing to the lack of rainfall in the summer months. Despite this, the great increase in efficiency of coal-burning plants resulted in coal conservation. The coal-burning plants, on the average, produced 1 kw.-hr. of electricity with 1.87 lb. of coal, as compared with 2.15 lb. of coal last year.

Briefer News

Growth of Lawton (Okla.) Plant.—A new 5,000-kw. steam turbine will go into operation at the generating station of the Southwestern Light & Power Company in Lawton, Okla., about Feb. 1. This turbine will double the capacity of the plant at Lawton, making it one of the largest steam plants in the entire Southwest.

Three Power Dams on Cumberland River, Tenn., to Serve Nashville, Asked.—Three power and navigation dams for the upper Cumberland River in Tennessee, instead of nine smaller dams, for navigation only as first proposed, are being sought by the Cumberland River Improvement Association. The aim of the association is to bring the power thus generated to Nashville.

United Gas Improvement's Iowa Properties to Have Central Office at Fort Dodge.—The central executive office of the Central Iowa Power & Light Company and the Iowa Light, Heat & Power Company is to be established in Fort Dodge. Both companies are subsidiaries of the United Gas Improvement Company of Philadelphia. They comprise more than 200 operating units.

Wisconsin Companies Seek Uniform Rural Rates.—To stimulate the spread of electricity in rural communities the Wisconsin Power & Light Company, Wisconsin River Power Company, Beloit Water, Gas & Electric Company, Central Wisconsin Power Company and other Insull subsidiaries in Wisconsin have petitioned the Railroad Commission for authority to establish uniform rates for rural electric service in 23 counties.

Industrial Lighting Activity Now Reaches 1,219 Cities and Towns.—The industrial lighting committee of the National Electric Light Association has issued a list of 1,219 cities and towns which are now participating in the campaign for better lighting in industrial establishments. These places represent a total population of 38,000,000 out of 71,000,000 reached by electricity. They are scattered through forty-one states, with some in Canada.

A. I. E. E. Section to Hear Analysis of Trend of the Industry.—John F. Gilchrist of the Commonwealth Edison Company, Horace P. Liversidge of the Philadelphia Electric Company, Harold V. Bozell of Bonbright & Company and Robert M. Davis, statistical editor of the ELECTRICAL WORLD, will analyze the trend of the electric light and power industry on the evening of Jan. 29 before the New York Section of the A. I. E. E.

Houston Lighting & Power Company's Construction Plans.—The budget of the Houston (Tex.) Lighting & Power Company for 1926 calls for the expenditure of $2,734,353 on improvements. Extensions will include a 30,000-kw. turbo-generator at the Deepwater plant, costing $800,000, which will virtually double the capacity of the company; two underground circuits to serve the business section of Houston, $530,000 to be expended on meters for street, lighting systems and short-line extensions, and $675,664 on miscellaneous improvements.

Baltimore Company Buys Block of Stock in Pennsylvania Water & Power.—The Maryland Public Service Commission has sanctioned the purchase of 10,000 shares of the stock of the Pennsylvania Water & Power Company by the Consolidated Gas, Electric Light & Power Company of Baltimore, constituting about a 10 per cent interest. Rumors of a possible merger are emphatically denied, it being explained that an interest in the Pennsylvania company is desired by the Baltimore company to insure the supply of hydro-electricity it draws from the Holtwood plant.

Equipment for Richmond Station Taxes Transportation.—To transport the six 20,000-kva. tap-changing transformers now being installed in the new Richmond station of the Philadelphia Electric Company, each of which is 20 ft. high and weighs approximately 50,000 lb., from the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh to Philadelphia it was necessary to use special depressed steel cars; otherwise the railroad tunnels would not have afforded sufficient headway. These transformers will raise the generator voltage from 13,200 to 66,000 for transmission to Bristol and Trenton. Next fall will see the shipment of a huge 600-ton frequency changer, 55 ft. long and 22 ft. above the foundation, and of eight 73,000-volt oil circuit breakers. It is estimated that 25 cars will be needed to take the frequency changer to the power plant.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Rocky Mountain Division, N. E. L. A.—Hot Springs Hotel, Idaho Springs, Col., Jan. 25-26. O. A. Weller, Public Service Company, Denver.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers — Midwinter meeting, New York, Feb. 8-11; regional meetings: Cleveland, March 18-19; Madison Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Eastern Association of Electrical Inspectors—Hartford, Conn., Feb. 10. E. P. Slack, 123 William Street, New York.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Local Bldg., Oklahoma City.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, March 17-18. R. V. Prather, 205 Mine Workers' Bldg., Springfield, Ill.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Pacific Gas Buys Oakland Property.—A parcel of eight acres of land adjoining present holdings of 53 acres at the foot of Fiftieth Avenue, Oakland, Cal., has been purchased by the Pacific Gas & Electric Company for future plant extensions in its East Bay territory. A three-quarter-million-dollar substation is now being erected on the original piece of property, and it is probable that any future steam-plant additions to the company's San Francisco Bay system will be made at this point.

Student Convention of Northeastern A.I.E.E. Planned for Spring.—Plans are under way for a Northeastern District, A.I.E.E., student convention to take place at the Massachusetts Institute of Technology, Cambridge, in the spring. Arrangements are being made by a committee headed by the chairman of the M. I. T. Branch acting with the advice and assistance of the executive committee of the Boston Section. Papers will be presented by students, and trips will be made to points of electrical interest in and about Boston. A joint banquet with the Boston Section is also contemplated.

Missouri Public Service Commission Gives Conditional Approval to Bagnell Plant.—Conditional authorization for construction and operation of the proposed dam and hydro-electric plant on the Osage River, near Bagnell, Mo., to cost $10,000,000 or more, was obtained from the Public Service Commission last week by the Missouri Hydro-Electric Power Company. The company must obtain consent of Benton, Camden, Miller and Morgan Counties to construction of the project and must pay any damages. The great reservoir involved in the ambitious plans would spread into these counties. (See ELECTRICAL WORLD for Oct. 31, page 917, and Nov. 28, page 1122.)

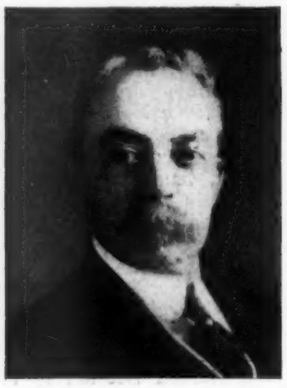
Holston River Project Opposed by Tennessee Eastern Electric Company.—At the public hearing held Jan. 11 at Bristol, Va., on the Holston River Power Company's project to develop 74,000 hp. from three dams between Kingsport and Bluff City, on the Holston River, in upper Tennessee, the uppermost to be 130 ft. in height and to back up the water for 20 miles, strong opposition was voiced by the Tennessee Eastern Electric Company, which has headquarters at Johnson City and a development on the Nolichucky River. This company contends that it is not within the power of the Federal Power Commission to grant a permit for the Holston River, since it is not navigable. It also discloses that it has already spent a large sum on preliminary work looking to the development of a power site of its own, which would be seriously interfered with by the proposed new development.

Men of the Industry

E. D. Adams Wins John Fritz Prize

Edward Dean Adams, engineer, financier and scientist, has been made the recipient of the John Fritz gold medal for his work toward developing hydro-electric power at Niagara Falls. Mr. Adams was selected as the winner of this year's medal by a board of sixteen representatives of the American societies of electrical, mechanical, civil and mining and metallurgical engineers.

Mr. Adams was president of the



E. D. ADAMS

Cataract Construction Company at the time it built the first hydro-electric central station at Niagara Falls, and subsequently he became president of the Bullock Electric & Manufacturing Company. He was formerly a director of the Allis-Chalmers Company, Allis-Chalmers Bullock, Ltd., of Montreal, the Bullock Electric Manufacturing Company and the Cataract Power & Conduit Company and at the present time is serving on the board of the Niagara Falls Power Company.

Mr. Adams has been vice-chairman of the Engineering Foundation from its beginning. In addition, he is a member of the executive board of the National Research Council and of the executive committee of its engineering division, a member of the American Institute of Electrical Engineers, the American Association for the Advancement of Science and of many other societies.

John Hull, who has been connected with the Ravenna (Neb.) office of the Central Power Company, has been promoted to the position of district manager.

H. M. Atkinson, chairman of the board of directors of the Georgia Railway & Power Company and a pioneer in electric power development in the South, has been voted Atlanta's most valuable citizen in 1925 by a committee representing the city and ten organizations of men and women. The committee's selection of Mr. Atkinson was, according to its announcement, based on his activities in industrial development of the north Georgia region through great water-power projects, two of which were completed in 1925 and another started during that year.

W. K. Vanderpoel Joins Okonite Organization

William K. Vanderpoel, since 1916 general superintendent of distribution of what is now the electric department of the Public Service Electric & Gas Company, Newark, N. J., has resigned to become vice-president and executive engineer of the Okonite Company and the Okonite-Callender Company, Inc., manufacturers of wire and cable for electric purposes, with factories at Paterson and Passaic and general offices in New York City. Mr. Vanderpoel ranks high among the electric distribution engineers of the country.

He affiliated himself with Public Service in 1907 as superintendent of distribution for the Essex Division, then as now the largest in the Public Service system, and Jan. 1, 1916, was made general superintendent of distribution, his jurisdiction extending over the transmission, distribution and customer utilization plant.

Mr. Vanderpoel's service has been not only to Public Service but to the industry in general. He has long been identified with the American Institute of Electrical Engineers, the National Electric Light Association and other technical organizations. In the N.E.L.A. he is at present vice-chairman of the Technical National Committee, was chairman of the overhead systems committee in 1920 and 1921 and has at various times served as chairman or member of other important committees. He is a manager of the American Institute of Electrical Engineers and has served or is serving on the executive, finance, power, standards, Edison medal and other committees of that association. Prior to entering the Public Service organization Mr. Vanderpoel

W. K. VANDERPOEL

was engaged in mining in South America. He has visited various European power installations in order to familiarize himself with foreign transmission and distribution practice, especially as regards high-voltage cable work.

S. D. Heed President of Electric Household Utilities Corporation

S. D. Heed, who has been elected president of the Electric Household Utilities Corporation (formerly the Hurley Machine Company with headquarters at Chicago), as announced in the Dec. 26 issue of the ELECTRICAL WORLD, has to its credit a record of unusual and striking achievements in the engineering field. Following graduation from Swarthmore College in 1907 he entered the employ of the Pennsylvania Railroad in the department of terminals and tunnels in New York City, where he remained for four years, subsequently engaging in sales work. When Gustav Lindenthal built the Queensboro Bridge in New York City he selected

S. D. HEED

Mr. Heed as resident engineer in charge.

Shortly after this country entered the World War Mr. Heed became a captain in the ordnance department and at the end of the war remained in the service of the government. After one year and a half of government service Mr. Heed was made special Assistant Secretary of War, with full executive powers, and proceeded to Nitro, W. Va., where he made a final disposition of the government-owned power plant to private interests.

Leaving the government service in 1921, he joined the Union Gas & Electric Company of Cincinnati as general manager and in 1923 was elected a vice-president. In 1924 and 1925 Mr. Heed served as president of the Cincinnati Electric Club and in 1925 he was chosen vice-chairman of the Commercial National Section of the National Electric Light Association. In that year also Mr. Heed was elected a vice-president of the Columbia Engineering & Management Corporation. He assumed his new duties as president of the Electric Household Utilities Corporation on Jan. 1.

A. S. Durant, formerly manager of the department of the Americas, has been made a vice-president of the International General Electric Company, in charge of commercial relations, with headquarters in New York City. **James C. Ryan**, formerly sales manager of the department of the Far East, has been appointed general sales manager with responsibility for all sales of apparatus

and supplies. **E. A. Baldwin,** formerly manager of the department of Europe, has been appointed manager of the Schenectady office, with responsibility for engineering and contract relations.

E. W. Lloyd Made Vice-President of Commonwealth Edison

E. W. Lloyd, general contract agent for the Commonwealth Edison Company for the past nineteen years, has been elected a vice-president of that organization. Mr. Lloyd's promotion to an executive position follows thirty-three consecutive years of service. It was in 1893 that he affiliated himself with the Chicago Edison Company, predecessor of the Commonwealth Edison Company, serving in the drafting department, on engineering tests, in the construction department and in the sales department. In 1901 he was made assistant superintendent of construction and in 1906 became general contract agent.

E. W. LLOYD

For many years Mr. Lloyd has been active in the Commercial Section of the National Electric Light Association and at the present time is serving as its chairman. Mr. Lloyd's interest has by no means been confined to the Commercial Section, but on the contrary has embraced general association affairs. He is an associate member of the American Institute of Electrical Engineers and a member of the Association of Edison Illuminating Companies, the Illuminating Engineering Society, the Electric Club of Chicago and other organizations.

P. S. Klees has resigned as sales manager of the Tubular Woven Fabric Company, Pawtucket, R. I. He was formerly general sales manager of the Franklin Electric Manufacturing Company and has been a prominent figure in the electrical manufacturing industry for many years. Mr. Klees has not yet announced his future plans.

D. C. McClure, general superintendent of the St. Joseph (Mo.) Light, Power & Railway Company and formerly superintendent of the electric department of the Public Service Company of Colorado, has resigned his position to become vice-president of a Mid-Western utilities holding company with headquarters in Chicago. Mr. McClure at the time of his transfer to the Missouri property was president of the Rocky Mountain Division of the National Electric Light Association.

Ralph Pool, vice-president in charge of operations of the Western Public Service Company, with headquarters at Colorado Springs, until the purchase of that company by the Stone & Webster interests several months ago, has joined the ranks of the Electric Bond & Share Company. At present he is on a special assignment in Dallas, Tex.

S. Z. De Ferranti, inventor and engineer, has been made an honorary member of the British Institution of Electrical Engineers. Mr. Ferranti was a pioneer in the development of the electrical industry, and his inventions in various lines are among the most notable contributions to the industry's progress. He is a former president of the Institution to honorary membership in which he has just been elected.

E. C. Van Diest, organizer and president of the Western Public Service Company, which sold its holdings in Wyoming, Nebraska, Colorado, Missouri and Texas to Stone & Webster several months ago, has definitely retired from the utility business. Mr. Van Diest is devoting his time to civic interests in the Rocky Mountain region.

Roger Williams has become associated with Landers, Frary & Clark as manager of the heating appliance division in the New York territory. Mr. Williams until the fall of last year had for a number of years been New York manager for the Simplex Electric Heating Company.

Charles H. Brough, ex-Governor of Arkansas, has been appointed director of the Arkansas Public Service Information Bureau to succeed Earle W. Hodges, whose resignation was announced in the Dec. 19 issue of the ELECTRICAL WORLD. Mr. Brough served for two terms as Governor of the state, from 1917 to 1921, and for twelve years previous to the tenure of that office had been on the teaching staff of the University of Arkansas, Fayetteville.

E. M. Staehle, formerly in charge of industrial advertising for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, has resigned to become the Eastern representative of the Keystone Mining Catalogs. Mr. Staehle, who succeeds Edward B. Day, will have his headquarters at the offices of the McGraw-Hill Company, New York, which recently acquired the Keystone catalogs and directories.

S. R. Inch President of Florida Power & Light

S. R. Inch has been elected president of the Florida Power & Light Company, recently organized as a vehicle for the operation of Florida properties under the supervision of the Electric Bond & Share Company. Mr. Inch, who is well known in the light and power field, came to America from England in 1900. At first he affiliated himself with the Montana Power Transmission Company, one of the predecessors of the present Montana Power Company, and later assumed the managership of a group of public utilities owned by the late Senator W. A. Clark. In 1913 he transferred his interests to Utah, becoming general superintendent of the Utah Power & Light Company, subsequently being promoted to be operating manager and later vice-president and general manager. He also served as vice-president of the Utah Light & Traction Company. Mr. Inch removed to the New York office of the Electric Bond & Share Company in 1923, where he will maintain his headquarters.

S. R. INCH

Obituary

Charles H. Baker, who for fourteen years had been in the employ of the Adriance Machine Works, Inc., as special sales representative and later as sales manager of the sheet-metal-working department, died last week at the Irvington (N. J.) Hospital following a minor operation. Mr. Baker entered the employ of the Detroit Electric Works in 1890, later joining the Walker Electric Company of Cleveland. In 1900 he became erecting engineer for the General Electric Company, remaining there seven years and resigning to affiliate himself with the Crocker-Wheeler Company in a similar capacity. It was while with the Crocker-Wheeler Company that Mr. Baker met the late Colonel Benjamin Adriance, who induced him to associate himself with the Adriance company. Mr. Baker was 66 years of age.

R. A. Storm, manager of the structural department of the Morgan Engineering Company, Alliance, Ohio, died at his home in that city Jan. 2. Mr. Storm affiliated himself with the Morgan Engineering Company as superintendent of the structural department in 1916. When the Morgan Engineering Company embarked in the rebuilding of locomotives Mr. Storm was made manager of the boiler department and afterward manager of the structural department. Mr. Storm was well known to the fabricating trade as an authority on electric arc welding of structural steel, having spoken before different organizations on this subject. Mr. Storm was 43 years of age.

Commission Rulings

Value of Plant Held to Serve Oregon Consumers Only Deducted from Valuation of Washington Utility.—A dispute of long standing has been settled by the Washington State Department of Public Works, which has deducted from its valuation of the Pacific Power & Light Company's property the value of a plant across the border in Oregon but on the Walla Walla River and theretofore regarded as forming part of the loop known as the Yakima-Walla Walla system, which serves five counties. The Department of Public Works held that the plant in Oregon, the eighth in the ring, serves customers in that state only and reduced the valuation figures nearly $100,000 to eliminate it as a factor in setting Washington rates.

Ten Days' Notice Before Hearings on Security Issues Insisted On.—The Public Service Commission of Indiana has issued a new rule which provides that petitions from public utility companies for permission to issue securities must be on file ten days before they can be heard. Ten days' notice likewise must be given to the public of these requests before the commission can hear evidence, but the two periods may be concurrent. The same rule provides that no final order can be made by the commission authorizing the issuance of such securities until after a public hearing. It was explained that in adopting the new rule the commission aimed to prevent undue haste. Frequently in the past companies have filed petitions with the commission and have attempted to have a hearing the same day.

Non-Stockholders in Rural Company Cannot Be Discriminated Against as Such, but Should Pay Connection Charge.—In granting to the Sylvan Electric Company, serving 45 rural customers, all but two of whom are stockholders, permission to increase its rates, the Wisconsin Railroad Commission said that although a higher electric rate should not be applied in the case of non-stockholders by way of compensating for the fact that they have contributed nothing toward the construction of lines whereas stockholders have made payments for that purpose, none the less an electric utility, while it has no power to compel prospective customers to purchase stock as a condition precedent to their connection to its system, should collect a connection charge large enough to equalize service conditions.

Oil-Electric Locomotives Held to Comply with Law Forcing Railroad Electrification.—The use of oil-electric locomotives, storage-battery locomotives and overhead electric systems has been authorized by the New York Public Service Commission for various railroads in New York City and held by it to comply with the provisions of the law requiring electrification of all roads. The New York, New Haven & Hartford Railroad Company, which had petitioned for the right to use steam engines for hauling certain emergency and wreck trains on the grounds of safety, will be required to use oil-electric locomotives. In the Van Nest yard the company was authorized to use a storage-battery locomotive. The commission prescribed operation either by an overhead distribution system or oil-electric locomotive for the New York Dock Railway. An overhead distribution system for the use of storage-battery locomotives was prescribed for the Bush Terminal Company. Use of oil-electric locomotives by the Brooklyn Eastern District Terminal was approved.

Recent Court Decisions

That Community Served by Utility Is Retrograding Does Not Justify Refusal in Valuation Proceedings to Consider Cost of Reproduction. — The United States District Court in Wisconsin has held, in Ashland Water Company vs. Railroad Commission, that the fact of a city being in an unprosperous condition and losing population does not justify any refusal, in fixing a rate base, to give at least fair and reasonable consideration to evidence of present cost of reproducing property, such a fact warranting no exception to the rule that reproduction new must have, if not the dominant, at least a due and reasonable consideration. (7 Fed. (2d.) 924.)*

Reproduction New Rather than Average Prices Over Period of Years Proper Basis of Valuation.—The United States District Court at Madison, Wis., has issued a decree in favor of the plaintiff in Oconto City Water Company vs. Wisconsin Railroad Commission, a suit to set aside rates fixed by the commission on the ground that they were confiscatory. The increased rates allowed by the court are in some instances 50 per cent higher than the old ones. Under the ruling just made rates must be based on present reproduction costs rather than on average prices taken over a period of years. The basis last named has been commonly employed by the commission, and the setting aside of this theory in Wisconsin might lead to substantial increases in the rates of public utilities of all kinds.

Mortgage of Municipal Plant in Michigan Must Carry Franchise and This Franchise Must Have Voters' Indorsement. — The Michigan Supreme Court, in Stanhope vs. Village of Hart, has declared illegal the action of the municipal officers in seeking to establish a hydro-electric plant to cost $127,500, although the electors had authorized bonds for this purpose in the amount of $62,500 only. The authorities proposed to mortgage the plant to raise the difference. The court pointed out that every such mortgage must carry an irrevocable franchise for a period not exceeding 20 years, to become operative in case of foreclosure, and that under the Michigan constitution such a franchise must have the approval of three-fifths of those voting at a regular or special election. The village authorities had contended that the section of the constitution providing for a mortgage and an accompanying franchise to be exercised in case of foreclosure stood by itself, but the court maintains that it must be read in connection with other sections of the constitution and that the trustees could not grant such a franchise without the indorsement of the electors.

Company Not Responsible for Accident Indirectly Caused by Its Assembly of Material. — In Georgia Railway & Power Company vs. Johnson, the Georgia Court of Appeals held that the power company, which placed certain poles, wires, cross-arms and insulators for the building of a power line in or near an old road and on land which the company had condemned, was not negligent so as to be liable for damages when plaintiff's mule, attached to a buggy, shied at these articles, ran away and threw plaintiff and his wife out of the buggy. (129 S. E. 891.)

Commission May Order Service Extended Even Though Existing Rates Are Confiscatory.—The United States Supreme Court has sustained the New York Public Service Commission's course in ordering the Woodhaven Gaslight Company to extend its mains and service to certain communities where development and prospects of growth warrant, even though the maximum rate, fixed by the statute and not alterable by the commission, now causes the company to operate at a loss which the extension would increase. The commission, the court said, was entitled to assume that the company would take the necessary steps to prevent confiscation, as in fact it had done at the time of hearing. (46 S. C. R. 83.)

Degree of Responsibility Assumed by Company for Action of Servant.—A verdict for the plaintiff in Bodine vs. Alabama Power Company, a case involving the destruction of timber on a right-of-way, was reversed and the case remanded by the Supreme Court of Alabama on the ground that, though a master is liable in common-law damages for the wrongful acts of a servant committed while acting within the scope of his employment, irrespective whether such acts were due to negligence or to a wanton or willful course, still the master cannot, when he did not in person direct the work, become amenable to a statutory penalty for destroying trees "willfully and knowingly, without the consent of the owner." In the case at issue the plaintiff conveyed to the Alabama Power Company a right-of-way 100 ft. in width across her lands for the construction and maintenance of a high-voltage electric transmission line. The right-of-way deed carried "the right to cut and keep clear all trees and undergrowth and other obstruction on said strip and dangerous trees adjacent thereto where necessary." It was alleged that the firm employed by the defendant to prepare the right-of-way had exceeded the rights allotted the company in this regard. (105 So. 871.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Advances

Moderate Gains Are Numerous—Substantial Improvement Is Shown by Selected Issues

IN GENERAL the market in power and light stocks gave a better performance in the week under review than did that in the shares of industrial and railroad companies. Money conditions have remained easy, but profit taking in many classes of stocks listed on the New York Stock Exchange has introduced a somewhat softer tone to prices. For the most part power and light stocks have not been subjected to these waves of selling, the thought being apparently that continued improvement in the conditions of the industry is more than an offset to market sentiment.

Not the least significant advances in the utility group recently have been those recorded for Lehigh Power Securities, Middle West Utilities and United Gas Improvement shares. Discussions of the terms of a split-up in Lehigh shares is what drove the stock up primarily, although Wall Street circulated other rumors in connection with that issue. Middle West Utilities rose to a new record high of 135 at one time on discussion of higher dividends for the stock and improved earnings. Basis for the spectacular rise in the United Gas Improvement shares has not been found, but traders point to the enormous concealed assets of the company and the likelihood that something more soon may be done for the stockholders. At any rate the stock has jumped 20 points within a fortnight, having risen in the present move from 115 to above 140 on heavy buying.

Activity in the shares of Southeastern Power & Light and Georgia Railway & Power shares is looked upon as a reflection of negotiations for control of the Georgia properties by Southeastern.

New Capital Issues

During the past week the Western United Gas & Electric Company made an offering of first mortgage thirty-year 5½ per cent gold bonds, series A, to the amount of $22,500,000, the price being 99 and accrued interest to yield over 5.55 per cent. Six per cent gold bonds, totaling $1,350,000, were issued by the Sioux City Service Company at 99 and interest, yielding 6.08 per cent. These bonds are guaranteed by the Sioux City Gas & Electric Company. The American Utilities Company took part in the week's financing to the extent of $1,250,000 in the form of first lien and refunding gold bonds, series A, priced at 97½ and interest, and the Central States Power & Light Corporation to the extent of $1,000,000 in the form of first collateral lien 6 per cent gold bonds, priced at 99 and interest. The Northeastern Power Corporation, the organization of which is discussed elsewhere in this issue, offered 300,000 shares of common stock at $35 per share. The entire issue was sold.

Increased Customer Sales During November.—Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during November a total of 312,000 shares were sold in this manner. The total value of the stock sold is estimated at $31,100,000, the highest figure since March, when record sales were reported. A total of 57,200 customers participated in the sales.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Allis-Chalmers Manufacturing, com.	$1.50	Feb. 15
American Light & Traction, com.	1¾	Feb. 1
American Light & Traction, pf.	1½	Feb. 1
American Superpower, pfc. pf.	.50	Feb. 15
American Wtr. Wks. & Elec., com.	1½	Feb. 15
American Wtr. Wks. & Elec., com.*	2½	Feb. 15
American Wtr. Wks. & Elec., 1st pf.	1½	Feb. 15
Associated Gas & Elec., cl. A	.62½	Feb. 1
Cities Service, bankers' shares†	.14½	Feb. 1
Commonwealth Edison, cap.	$2	Feb. 1
Eastern States Power, pf. A	$1.75	Feb. 1
Elec. Investors, $7 pf.	$1.75	Feb. 1
Elec. Investors, $6 pf.	$1.50	Feb. 1
Eureka Vacuum Cleaner	$1	Feb. 1
Idaho Power, pf.	1¾	Feb. 1
Illinois Northern Utilities, pf.	$1.50	Feb. 1
Middle West Utilities, com.	$1.25	Feb. 15
Mountain States Power, com.	$1.00	Feb. 1
National Elec. Power, com. A	.45	Feb. 4
Northern Indiana Gas. & El., pf. A.	1¾	Jan. 14
No. New York Utilities, pf.	$1.75	Feb. 1
Pacific Gas & Electric, pf.	1½	Feb. 15
Pacific Power & Light, pf.	1¾	Feb. 1
Philadelphia Co., com.	$1	Jan. 30
Public Service of No. Ill., 6% pf.	$1.50	Feb. 1
Public Service of No. Ill., 7% pf.	$1.75	Feb. 1
Public Service of No. Ill., com.	$2.00	Feb. 1
Public Serv. of No. Ill., com. no par	$2.00	Feb. 1
Southern Colorado Power, com. A.	.50	Feb. 25
Standard Power & Light, pf.	$1.75	Feb. 1
Texas Power & Light, pf.	1¾	Feb. 1
West Penn, 7% pf.	1¾	Feb. 15
West Penn Elec., 7% pf.	1¾	Feb. 15

*Payable in common stock. †Monthly

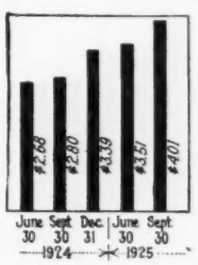
American Power & Light Steps Ahead

Earnings Have Grown in Every Month Since 1910 Until Annual Total Now Nears Fifty-Million-Dollar Mark—Balance Sheet Reveals Big Assets

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

SIXTEEN years ago gross earnings of the American Power & Light Company were running at an annual rate in excess of $1,000,000, but by the year ended Sept. 30, 1925, that modest total had grown to $48,192,940. For the facts that its income has mounted in every month since the company was organized and that its territory is more diversified than any to be found in the domain of other utilities, American Power & Light is unique. Through information just made available to the public by the president, C. E. Groesbeck, it is possible to obtain a recent picture of the financial position of this leading member of the group under supervision of the Electric Bond & Share Company.

American Power & Light Company owns substantially all of the common stocks, not to mention various amounts of other issues, of the Kansas Gas & Electric Company, the Pacific Power & Light Company, the Portland Gas & Coke Company, the Nebraska Power Company, the Minnesota Power & Light Company, the Superior Water, Light & Power Company, the Central Arizona Light & Power Company, the Florida Power & Light Company, the Northwestern Electric Company and the Southwestern Power & Light Company. Operating subsidiaries of the parent organization supply service to 505 communities, and 74 per cent of the gross earnings are derived from the sale of electric power and light, 15 per cent from the sale of manufactured gas and 9 per cent from water, ice and miscellaneous services. Only 1 per cent of the total represents electric railway revenue.



EARNINGS PER SHARE OF AMERICAN POWER & LIGHT COMMON STOCK AT END OF TWELVE-MONTH PERIOD INDICATED

In a recent announcement the company made public its balance sheet for a date as late as Sept. 30, 1925. On the liabilities side the total amount of capital stock somewhat exceeded the volume of bonds, there having been $38,797,712 in stock against $35,982,900 in bonds. The capital stock has no par value, but is represented by 232,716 shares of preferred stock, 1,608,204 of common and 663 scrip certificates for common shares. The bonds represent debenture 6's that mature in 2016. While investments on the asset side are carried at $60,533,302, it is plain that this figure is a conservative one from the standpoint of present values. Current assets, representing primarily

loans and accounts receivable, were carried at $16,279,007. Total assets on Sept. 30, 1925, were put on the balance sheet at $80,560,540.

While the market value of the common shares in the last two or three years has increased enormously, the improvement has been generally a belated recognition of growth that had been in process for years, but of which the securities market had taken little account. For the large sums patiently plowed back into the properties over a long period of years stockholders of the American Power & Light Company finally are receiving their rich reward. The company has reached a stage in its growth, in other words, when fair gains in gross revenues are likely to reflect proportionately greater gains in the earnings available for stockholders. For example, the per share earnings on stock issued rose between June 30, 1924, and Sept. 30, 1925, from $2.68 to $4.01.

Increase in Funded Debt Approved.—The California Railroad Commission has sanctioned the fifty-million-dollar bond limit for the California Oregon Power Company which was voted by the stockholders on Nov. 24 to replace the previous twelve-million-dollar mortgage limit.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 16	Low 1925	High 1925
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 72½	n 71½	n 74½
Adirondack Pwr. & Lt.—7% pf.	101½	98	106
Adirondack Pwr. & Lt.—8% pf.	108	103	115
Adirondack Pwr. & Lt., com.—50	m75	31	98
Ala. Pwr., pf.	k104	....	....
Allis-Chalmers Mfg. pf.	106	103½	109
Allis-Chalmers Mfg., com.	k 93	n 90½	n 94½
Aluminum Co. of Amer., com.	k 62	....	....
Aluminum Co. of Amer., new, pf.	k 98	....	....
Amer. & Foreign Pwr., pf. 25% pd.	k128	n128½	n131
Amer. & Foreign Pwr., 7% pf.—no par	k 91½	n 91½	n 92
Amer. & Foreign Pwr., com.—no par	k 41½	n 40½	n 42½
Amer Bosch Magneto, com.—no par	k 30	n 29½	n 34½
Amer. Brown, Boveri, Elec. pf.	m47½	47	48½
Amer. Brown Boveri Elec.	k 45½	n 45½	n 48½
Amer Elec. Pwr., pf.	c102½	91	104½
Amer. Gas & Elec., 6% pf.—no par	k 94	....	....
Amer. Gas & Elec., com.—no par	k 90½	n80	n 97½
Amer. Lt. & Trac., 6% pf.	114	93	119½
Amer. Lt. & Trac., com.	k254½	n232	n263
Amer. Pwr. & Lt., 6% pf.	k 95	n 94	n 96
Amer. Pwr. & Lt., com.—no par	k 79½	n 68½	n 79
Amer. Pub. Serv., 7% pf.	k 96½	....	....
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	82	....	....
Amer. Pub. Utilities, 6% pf.	84	71	82
Amer. Pub. Utilities, 7% pf.	86	87	95
Amer. Pub. Utilities, com.	79	70	103
Amer. States Sec., A	k 7½	....	....
Amer. States Sec. B	k 5	....	....
Amer. Superpwr., pf.—25	25½	24½	27
Amer. Superpower, pf.	91	92	95½
Amer. Superpwr., Class A—no par.	k 37½	n 33½	n 37½
Amer. Superpwr., Class B—no par.	k 38½	n 34½	n 39½
Amer. Wtr. Wks. & Elec., 7% pf.	k105½	n102½	n105
Amer. Wtr. Wks. & Elec., com.—20	k 72½	n 68½	n 74
Anaconda Copper	k 47½	n 46	n50⅝
Appalachian Pwr., 7% pf.	99	92	100
Appalachian Pwr., 1st pf., 7%	100	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	k 80	....	....
Arizona Pwr., com.	35	15	34½
Arkansas Cent. Pwr., pf., $7—no par	101	97	102
Arkansas Lt. & Pwr., 7% pf.	k 99	....	....
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	l101½	n100½	n102½
Assoc. Gas & Elec., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 80	....	....
Assoc. Gas & Elec., Class A	k 33	n 31½	n 35½
BABCOCK & WILCOX, com.	k147	n145	n148
nghamton Lt., Ht. & Pwr., pf.	101	90	101
Birmingham Elec. pf.—$7—no par.	101½	98	103
Blackstone Valley Gas & Elec., pf.	105	95	100
Blackstone Valley G. & E., com.—50	k106	n 97½	n118½
Blaw-Knox, com.	54½	59	60
Brazilian Trac., Lt. & Pwr., com.	f 83½	....	....
Broad River Pwr., pf.	93	90	97
Brooklyn Edison, com.	k136	n133½	n138
Buffalo Gen. Elec., com.—no par.	m58	50	77
Buffalo, Niagara & East. Pwr., pf.—25.	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com. —no par	k 37½	....	....
CALIFORNIA ELEC. GENERATING, pf.	91	89	93
California Ry. & Pwr., pf.	88	88	100
Carolina Pwr. & Lt., pf.—$7—no par	105	100	107½
Carolina Pwr. & Lt., com.	420	290	456
Cent. & S.W. Ut., 7% pf.—no par	a 90½	88	90½
Cent. & S.W. Ut., pr. ln. pf.—no par	m 98	92	100
Central Ariz. Lt. & Pwr., pf.	101	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	87	84	93
Central Ind. Pwr., 7% pf.	88	88	95
Central Pwr. & Lt., pf.	95	88	96½
Central States Elec., 7% pf.	93	87	98
Central States Elec., com.	250	70	250
Century Elec., com.	m103	103	110
Chicago Fuse Mfg., com., no par.	a 33	27½	39½
Cincinnati Gas & Elec., com.	g 89½	82	90
Cities Service, 6% pf.	84	80	84
Cities Service, pf. B—10.	k 7½	....	....
Cities Service, pf. BB—100.	k77	....	....
Cities Service, com.—20	38	34	43
Cities Service, Bks. Shrs.—10.	17½	16½	22
Clarion River Pwr., pf.	92	91	96
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	114½	104½	114½
Columbia Gas & E., com.—no par.	k88½	n 83½	n90
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	k100	....	....
Columbus Elec. & Pwr., com.	k150	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Col. Ry., Pwr. & Lt., com.—no par.	82	70	85
Commonwealth Edison, com.	a142	130½	141½
Commonwealth Pwr., 6% pf.	k 85½	n 85	n 87½
Commonwealth Pwr., com—no par.	k 41½	n 39½	n 42½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	110	105	110
Cons. Gas of N. Y., pf.—50	k 58½	..	..
Cons. Gas of N. Y., com—no par	k 98½	n 94½	n100
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c103	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	c108½	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c110½	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c125	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	c 50	32	47½
Cons. Utilities of Dela., 7% pf.	m85	80	84
Consumers Pwr., 6% pf.	96	90	97
Consumers Pwr., 6 6% pf.	101	97	102
Continental Gas & Elec., 7% ptc. pf	96	85	97
Continental Gas & Elec., 7% pr. pf.	95	89	97
Continental Gas & Elec., com—no par	140	77	152
Crocker Wheeler, com.	9	9	28
Crocker Wheeler, pf.	45	47	80
DALLAS PWR. & LT., 7% pf.	103	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	z135½	n133	n137½
Dubilier Condenser & Radio, com.	k 8½	n 8½	n11
Dubuque Elec., 7% pf.	94	80	90
Duquesne Lt., 7% pf.	k113	n112½	n113
EAST. N. Y. UTIL. pf.	70	71	80
Eastern New York Util., com.	55	52	65
Eastern States Power	k 31½	....	....
Eastern States Pwr., pf. with war'nt	k120	....	....
Eastern States Pwr., pf. without warrants	k 92	....	....
Eastern Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com —no par.	k105	n86	....
Edison Elec. Illum. of Boston, com.	d207	200	213
El Paso Elec., com.	k87	....	....
El Paso Elec., pf.	k101	....	....
Elec. Bond & Share, 6% pf.	k106	n103½	n107½
El. Bd. & Share Sec., com.—no par.	81	n 79	n 86
Elec. Investors, 6% pf —no par.	92	95	96
Elec. Investors, com.—no par.	k 72½	n 66	n74½
Elec. Investors, 10% pd. receipts.	49	15	62
Elec. Pwr. & Lt., ctfs. pf.	k91½	n 91½	n 92½
Elec. Pwr. & Lt., ctfs., 40% pd.	k106½	n105½	n107½
Elec. Pwr. & Lt., ctfs. full pd.	105½	n100½	n110½
Elec. Pwr. & Lt., ctfs. com.	k 31½	n 30½	n 32½
Elec Ry. Securities, com—no par.	k 7¾	n 4¾	n 7¾
Elec. Refrig.	k 88½	k86½	n 90½
Elec. Storage Battery, com.—no par	k 73½	n 73	n 75
Elmira Wtr., Lt. & R.R., 7% pf.	96	93	98
Emerson Elec., pf.	b102	101½	102
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par.	k101½	n 99½	n102½
Engr. Pub. Serv., com.—no par.	k 28½	n 24	n 29½
Eureka Vacuum Cleaner, com.—no par.	k 51	n 52	n 53½
FAIRBANKS MORSE, com.	k 55½	n 51	n 51
Fairbanks Morse, pf.	m108½	106½	110
Federal Lt. & Trac., com.	k 37½	n 36	n 39
Federal Light & Traction, pf.	m85½	82½	86
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l105½	n105	n107
GALVESTON-HOUSTON ELEC., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	k342	n323	n347½
Gen. Elec., special—10.	k 11½	n 11	n 11½
Gen. Gas & Elec., A	k 56½	n 55	n 59
Gen. Gas & Elec., pf. A	k 98½	n 98½	n 99½
Gen. G.&E., (Del.) com. A no par	56½	42	64½
Gen. G.&E., (Del.) com. B no par	45	40	62
Gen. G.&E., (Del.) A pf. $8 no par	110	90	111
Gen. G.&E., (Del.) A pf. $7 no par	98	97½	100
Gen. G.&E., (Del.) B pf. $7 no par	96	88	97½
Ga. Lt., Pwr. & Rys., 6% pf.	78	74	85
Ga. Lt., Pwr. & Rys., com.	59	25	74
Ga. Ry. & Elec., 5% pf.	m 70	78½	84½
Ga. Ry. & Elec., com.	m126	115½	115½
Ga. Ry. & Pwr., 8% pf.	112	101	114
Ga. Ry. & Pwr., 7% pf.	100½	100	102½
Ga. Ry. & Pwr., 4% pf.	150	62	150
Ga. Ry. & Pwr., com.	k151½	n146½	n160
Gt. Western Pwr., 7% pf.	h102	....	....
HAVANA ELEC. UTIL., com.	44½	42	45
Havana Elec. Util., pf.	m 69	66	70
Hurley Machine, com.—no par.	w 46	41½	56
IDAHO PWR., 7% pf.	101½	97½	102
Ill. No. Utilities, 6% pf.	88	82½	92
Ill. Pwr. & Lt., 7% pf.	97	92½	98
Int. Combt. Engr., com.—no par.	k 56½	n 53½	n 64½
Int. Utilities, class A—no par	k 38	n 37	n 39
Int. Utilities, class B—no par.	k 8¾	n 7½	n 9¾
Interstate Pwr., pf., $7, no par.	92	90	98
Interstate Pub. Serv., 7% pf.	96½	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
JERSEY CENTRAL PWR. & LT., 7% pf.	94	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par.	k151½	k152	n159
KANSAS GAS & ELEC., 7% pf.	l100	n 99½	n102
Kelvinator Corp., com—no par.	k 87½	n 86½	n 89½
Kentucky Hydro-Elec., pf.	a 93½	85½	94
Kentucky Sec., 6% pf.	75	67	78
Kentucky Sec., com.	90	77	100
Kentucky Utilities, 6% pf.	89	82	95
Keystone Pwr. & Lt. 7% pf.	94½	90	95
Kings County Ltg., 7% pf.	101	98	101
Kings County, Ltg., 8% pf.	104	103	160
LACLEDE GAS LT., com.	k163½	n161	n168
Lehigh Pwr. Sec., com.—no par.	k238	n190	n237½
Long Island Ltg., 7% pf.	104½	100	105
Long Island Ltg., com—no par.	145	80	142
Los Angeles Gas & Elec., 6% pf.	95	90	95
Louisville Gas & Elec., cl. A	k 25½	n 22½	n 25½
MANHATTAN ELEC. SUPPLY	k 66	n 56	n 67½
Manila Elec., com.—no par.	32½	28½	49½
Maytag Mfg., com.	k21½	n21½	v22½
Memphis Pwr. & Lt., pf., $7, no par.	103	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	98
Metropolitan Edison, pf., $7, no par.	102½	100	110
Metropolitan Edison, com., no par	45	45	50
Middle West Utilities, 7% pf.	a101	91½	99
Middle West Utilities, 7% pr. lien pf.	a111½	98	108
Middle West Utilities, com.—no par	a129½	92½	125
Midland Utilities, pr. ln. pf.	a 99	98½	101
Midland Utilities pf. A	a 96	92	97
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	87	83½	87
Minn. Pwr. & Lt., 7% pf.	l102½	n100½	n103
Miss. Pwr. & Lt., pf.	k102	....	....
Miss. River Pwr., 6% pf.	95	87½	94
Miss. River Pwr., com.	50	37	124½
Mohawk Hudson Pwr., 1st pf.—$7—no par	103	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	92	88	93½
Mohawk Hudson Pwr., com.—no par	28	20½	43½
Montana Pwr., pf.	m112½	109	117
Montana Pwr., com.	k 83½	n 78½	n 83½
Montreal Pwr., com.	f217	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 24	....	....
NASSAU & SUFFOLK, LTG., pf.	92	88	95
National Carbon com.	m124	120	130
National Carbon, pf.	a127½	120	137½
National Elec. Pwr., pf.	g 94	93	96½
National Electric Pwr. A.	k26½	n24½	n26½
Nat. Lt., Ht. & Pwr., com.—no par	101	95	99
National Lt., Ht. & Pwr., 5% pf.	70	40	72
National Pwr. & Lt., pf., $7—no par	k102½	n101½	n102½
National Pwr. & Lt., com.—no par.	k 36½	n 34½	n 38½
National Pub. Serv., 7% pf.	90	90	96
National Pub. Serv., ptc. pf.	93½	93	97½
National Pub. Serv., A com.—no par	k 22	n22	n 24
National Pub. Serv., B com.—no par	13½	13	20
Nebraska Pwr., 7% pf.	104	n103	n105
Nevada-Calif. Elec., com.	k 36	n 30½	n 42
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. ln. pf.	98	97½	99
New England Pub. Serv., pf.	95	95½	97
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	100	94	102
New Orleans Pub. Serv., com.—no par.	m 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Newport News & Hampton Ry., Gas & Elec., com.	105	85	100
Newport News & Hampton Ry., Gas & Elec., pf.	95	90	105
Niagara Falls Pwr., 7% pf.—25.	k 28	n 28	n 28½
Niagara, Lock. & Ont. Pwr., 7% pf.	m106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par.	m60½	60	73
Nizer Corp., A.—no par.	m 84½	37	84½
Nizer Corp., B.—no par.	k 87½	n 86	n89½
No. Amer., 6% pf.—50.	k 56½	n 49	n50½
No. Amer., com.—10.	k 66½	n 63½	n67
No. Amer. Edison pf.—no par.	93	93	97½
No. Amer. Lt. & Pwr., pf.	88	87	91
N.C. Pub. Serv., pf.—$7—no par.	20	11	30
No. Indiana Gas & Elec., pf. A	98	96	98½
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 23½	n 15½	n26½
No. Ohio Trac. & Lt., 6% pf.	76	64	75
No. Ohio Trac. & Lt., 7% pf.	85	85½	88
No. Ont. Lt. & Pwr., pf.	76	68	78
No. Ont. Lt. & Pwr., com.	59	41	52
No. States Pwr., 7% pf.	101	95	100
No. States Pwr. com.	k131½	n130½	n136½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
OHIO BRASS, com. B—no par.	74	72	67
Ohio Brass, pf.	99	92	102
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv., 6% pf.	89	88	93
Ohio Pub. Serv.: 7% pf.	99	97	100
Ohio River Edison, pf.	99½	93½	100½
Oklahoma Gas & Elec., pf.	k95	....	....

Stock Exchange: cChicago; kSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; tPittsburgh; jWashington. kBid, low, high, Tuesday, Jan. 19. lBid, low, high, Wednesday, Jan. 20. mLatest quotations available. n1926.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 16	Low 1925	High 1925
STOCKS—Continued			
PACIFIC GAS & ELEC., 6% pf.	98	92	99
Pacific Gas & Elec., com.	k128¼	n126¼	n130
Pacific Pwr. & Lt., 7% pf.	98	n 98	n101
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.-no par	c 73	60	73
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	96	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	105	101	110
Penn Pwr. & Lt.—$7 no par	l 105	n103	n106
Penn Pub. Serv., 7% pf.	98	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., com.	e171	120½	185
Phila. Co., pf.—50	k 48	n47½	n48¼
Phila. Co., com.—50	k 65½	n63	n70½
Phila. Elec., com.—25	c 59½	37½	58
Pittsburgh Utilities, pf—10	k 15½	n15½	n16½
Portland Elec. Pwr., 7% pf.	97	95	99
Portland Elec. Pwr., 6% pf.	71	70	80
Portland Elec. Pwr., com.	k 47	n45	n48¼
Portland Ry., Lt. & Pwr., pf.	m 72	....	....
Portland Ry., Lt. & Pwr., com.	m 41	....	....
Potomac Elec. Pwr., pf.	j107½	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	96	112
Pwr. Corp. of N. Y., com—no par	k 89½	....	....
Pwr. Sec., pf.—no par	23	10	55
Pwr. Sec., com.—no par	7	8	30
Pub. Serv. of N. J., 7% pf.	k105	n103½	n105⅞
Pub. Serv. of N. J., 8% pf.	k117	n115½	n116
Pub. Serv. of N. J., com—no par.	k 92½	n 79⅞	n 90½
Pub. Serv. of No. Ill., 6% pf.	a102½	92	101
Public Serv. of No. Ill., 7% pf.	a113½	102	111
Pub. Serv. of No. Ill., com.—no par	a133	107½	132¼
Pub. Serv. of No. Ill., com.	a132	118	131
Pub. Serv. of Okla., 7% pf.	92	87	95
Pub. Serv. Elec. & Gas, 6% pf.	m98⅞	92½	100⅛
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	k 84	....	....
Puget Sound Pwr. & Lt., com.	k 61	....	....
RADIO CORP. of Am., pf.—50	46	45	54
Radio Corp. of Amer., com.—no par	k 43½	n 42	n 46⅝
Republic Ry & Lt., pf.	106	70	93
Republic Ry. & Lt., com.	90	49	67
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	98	96	100
Rochester Gas & Elec., 7% pf.	104	103	106½
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	60	65
Servel Corp., Class A	k 29½	n 29	n 30⅛
Servel Corp., Class B—no par	58	35	62½
Sierra Pacific Elec., com.	k 26½	n25⅛	n28⅝
Sioux City Gas & Elec., 7% pf.	98	97½	99½
S. E. Pwr. & Lt., 7% pf.—no par	98	90	100
S. E. Pwr. & Lt., com—no par	k 45½	n 40⅞	n 46⅞
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110	105	107½
So. Calif. Edison, 6% pf.	97½	90	95½
So. Calif. Edison, com.	k134	n128	n140
Southern Cities Utilities, 7% pf.	86	77	100
Southern Cities Utilities, com.	45	30	71
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	25	52	56
Southwestern Lt. & Pwr., B	42	31½	42½
Southwestern Lt. & Pwr., 6% pf.	78	....	90
Southwestern Pwr. & Lt., 7% pf.	100	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	m 56	....	....
Standard Gas & Elec., 7% pf.	99	96	100
Standard Gas & Elec., com.—no par	k 60½	n 55⅞	n 59⅛
Standard Pwr. & Lt., 7% pf.	91	95	114½
Superheater, com.—No par	140	120	152
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	270	115	265
TAMPA ELEC., com.	k305	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	87
Tenn. Elec. Pwr., 7% pf.	99½	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	m 80	....	....
Tenn. Elec. Pwr., com.—no par.	m 65	....	....
Terre Haute, Ind. & East Trac., pf.	27	22	35
Terre Haute, Ind. & East. Trac., com.	3	2½	....
Tex. Pwr. & Lt., 7% pf.	l103	n102	n104
Tide Water Pwr., 8% pf.	k 99	....	....
Timken Roller Bearing, com—no par	k 53⅞	n 52⅞	n 56⅜
Toledo Edison, 8% pf.	111	109	114
Toledo Edison, 7% pf.	101½	94	101½
Toledo Edison, com.	l 25	21	25
Tri-City Ry. & Lt., 6% pf.	88	82	85
UNITED GAS & ELEC., 6% pf.	92	80	94
United Gas & Elec., com.—no par.	58½	....	....
United Gas & Elec. (N. J.), 5% pf.	68	55	65
United Gas Impr.—50	c130½	79½	124½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	89	83	99
United Lt. & Pwr., com., A—no par.	138	....	....
United Lt. & Pwr., com., B—no par.	150	49	100
Utah Pwr. & Lt., 7% pf.	l101½	n 99	n102½
Utica Gas & Elec., 7% pf.	104	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	92	90	97
Utilities Pwr. & Lt., com. B—no par	k 16½	n 16	n 17½
VERMONT HYDRO - ELEC., 7% pf.	94	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	m149	64½	150
WAGNER ELEC., pf.	b 84½	83½	85
Wagner Elec., com.—no par	b 33½	32½	34½
Washington Ry. & Elec., pf.	j 91	....	....
Washington Ry. & Elec., com.	j207	....	....
Washington Wtr. Pwr., com.	130	110	140
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf.	k 97⅛	n 96¼	n 96⅝
West Penn. com.	122	97½	145
West Penn Elec., pf. A—$7—no par	k 97½	n 96⅝	n 97½
West Penn Elec., class A, ctfs.	k 89¼	n 88⅛	n 90
West Penn Pwr., pf.	m109½	n 109	n109½
West Va. Lt., Ht. & Pwr., 7% pf	94	94½	96½
West Va. Utilities, 7% pf.—50	43½	38	47
Western Pwr., 7% pf.	k 99	n 96	n 98½
Western Pwr., com.—no par	80	34	102
Western States Gas & Elec., 7% pf.	89	82	92
Western States Gas & Elec., com.	k 19½	....	....
Westinghouse El. & Mfg., com—50	k 74⅛	n 72½	n 75⅜
Weston Elec. Instrument, Cl. A	k 28⅛	n 27⅛	n 28⅜
Weston Elec. Instrument, com.	k 16⅛	n 16⅛	n 17⅛
Wheeling Elec., pf.	90	88	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	78½	76	88
Worthington Pump, pf. B	61	58	76½
Worthington Pump, com.	k 41	n40½	n 44½
YADKIN RIVER PWR., 7% pf.	l102½	n102	n105
Yale & Towne, com.—25	k 63	n 62⅝	n 64½
BONDS			
ABITIBI PWR. & PAPER	6s 1940	100	98	101½
Adir. Elec. Pwr.	5s 1962	100	97½	101
Adir. Pwr. & Lt.	6s 1950	105½	102½	105½
Adir. Pwr. & Lt.	5s 1930	97	94	98
Ala. Pwr.	5s 1946	99½	96	100
Ala. Pwr.	5s 1951	96	92½	97½
Ala. Pwr.	6s 1951	104	101½	105
Ala. Trac. Lt. & Pwr.	5s 1962	121	86	115
Aluminum Co. of Amer.	7s 1933	k106	n106	n106
Amer. Bosch Magneto	8s 1936	m103	....	....
Amer. Gas & Elec.	5s 2007	91½	90	93½
Amer. Gas & Elec.	6s 2014	k 99	n 98	n 99
Amer. Pwr. & Lt.	6s 2016	k 97	n 96	n97½
Amer. Pub. Serv.	6s 1942	98½	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	96	92½	98
Amer. Wtr. Wks. & Elec.	6s 1975	k 94	n 94	n 94½
Anaconda Copper	6s 1929	103½	102½	104
Anaconda Copper	6s 1953	102	99½	102
Anaconda Copper	7s 1938	104	99½	105½
Appalachian Pwr.	5s 1941	98	96	99½
Appalachian Pwr.	6s 2024	92½	87	94
Appalachian Pwr.	7s 1936	105½	105	106½
Arizona Pwr.	6s 1933	100	97½	101
Arizona Pwr.	6s 1947	96	90	96
Ark. Central Pwr.	6s 1948	101	98½	102½
Ark. Lt. & Pwr.	6s 1945	103½	100	104
Ark. Lt. & Pwr.	6s 1954	99	92½	99
Assoc. Gas & Elec.	6s 1965	k 94½	n 94½	n 95½
Assoc. Gas & Elec.	6½s 1954	100½	94½	106
BINGHAMTON LT., HT., & PWR.	5s 1946	98½	94½	99
Birmingham Elec.	6s 1954	102½	99	103
Birmingham Ry., Lt. & Pwr.	4½s 1954	88½	85	89½
Broad River Pwr.	6½s 1934	100½	99	102
Brooklyn Edison	5s 1949	103½	99½	103½
Brooklyn Edison	6s 1930	105	103½	106
Buffalo Gen. Elec. 1st.	5s 1939	102	100	102½
Buffalo G. E. 1st & Ref.	5s 1939	101½	100	101½
Burlington Ry. & Lt.	5s 1932	94½	90	96
Butte Elec. & Pwr.	5s 1951	100	99	100½
CALIF GAS & ELEC.	5s 1937	100½	98	101½
Calumet Gas & Elec.	5½s 1960	96½	97	98½
Canadian Lt. & Pwr.	5s 1949	55	36	62
Canton Elec.	5s 1937	99½	99	100½
Carolina Pwr. & Lt.	5s 1938	100	98½	100½
Carolina Pwr. & Lt.	6s 1953	104½	103½	105
Cedar Rap. Mfg. & Pwr.	5s 1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s 1928	99	98½	100
Central Ga. Pwr.	5s 1938	95½	93	97
Central Ill. Lt.	5s 1943	98½	94	99½
Central Ill. Pub. Serv.	5s 1952	89½	84½	92½
Central Ill. Pub. Serv.	5½s 1950	95½	96½	98
Central Ill. Pub. Serv.	6s 1944	99½	96½	101½
Central Ind. Pwr.	6s 1947	98	95½	99½
Central Ia. Pwr. & Lt.	6s 1944	99½	97	101
Central Maine Power	5s 1939	98½	98½	100
Central N. Y. Gas & El.	5s 1941	96½	94	97½
Central Pwr. & Lt.	6s 1946	100	97½	101
Central Pwr. & Lt.	6½s 1952	101½	94	102½
Central States Elec.	5s 1926	m 99	....	....
Chattanooga Ry. & Lt.	5s 1956	83½	81	85
Cincinnati Gas & Elec.	5s 1956	102½	98½	102½
Cincinnati Gas & Elec.	5½s 1967	104½	100½	105
Cities Service	6s 1966	k 92½	n 92½	n 93½
Cities Service	7sB 1966	126	150⅝	178½
Cities Service	7sC 1966	k126	n126	n126
Cities Service	7sD 1966	k102	n101½	n101½
Cities Service	7s E 1966	k109½	....	....
Cities Service Pwr. & Lt.	6s 1944	k 93⅞	n 93⅛	n 94½
City Lt. & Trac., Sedalia, Mo.	5s 1952	84	74	85½
Cleveland Elec. Illum.	5s 1939	102½	100	103
Cleveland Elec. Illum.	5s 1954	101½	97½	102
Cleveland Elec. Illum.	7s 1941	110	109	111½
Colorado Pwr.	5s 1953	95½	93	96½
Columbia Gas & Elec.	5s 1927	99½	99½	101
Columbia Ry., Gas & El.	5s 1936	92½	92½	95
Columbus, Dela. & Marion Elec.	5s 1937	94	83	88
Columbus, Dela. & Marion Elec.	6s 1937	94	91	98
Columbus Elec. & Pwr.	6s 1947	k102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	97	93½	98½
Columbus Ry., Pwr. & Lt.	6s 1941	104½	103½	105
Commonwealth Edison	5s 1943	102	99½	102½
Commonwealth Edison	5s 1953	100	98½	101
Commonwealth Edison	5s 1954	100	98	101
Commonwealth Pwr.	6s 1947	103	97½	103½
Community Pwr. & Lt.	6s 1950	98	94½	99
Conn. Ry. & Ltg.	4½s 1951	91½	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s 1962	80½	75½	82½
Consol. Elec.	5s 1955	97½	94	98½
Consol. Gas of N. Y.	5½s 1945	105½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	97½	95½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	c105½	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	c100½	99	100½
Con. Gas, Elec. Lt. & Pwr. of Balti. notes.	5½s 1952	c 105½	102½	105½
Consumers Elec. Lt. & Pwr.	5s 1936	95	93	96½
Consumers Pwr.	5s 1936	100½	99	101
Consumers Pwr.	5s 1952	99	90½	100
Consumers Pwr.	5½s 1954	103½	99	104½
Continental Gas & Elec.	5s 1927	99½	99½	101
Continental Gas & Elec.	6s 1947	99½	98	101½
Continental Gas & Elec.	6½s 1964	98½	96½	100
Continental Gas & Elec.	7s 1954	105½	99	105½
Cumberland Cty. Pwr. & Lt.	5s 1942	95½	92	96½
DALLAS PWR. & LT.	6s 1949	104	103	105½
Dayton Ltg.	5s 1937	100	98½	100½
Dayton Pwr. & Lt.	5s 1941	100	97	100½
Defiance Gas & Elec.	5s 1942	97	88½	97½
Denver Gas & Elec.	5s 1949	98	97½	100
Denver Gas & Elec. Lt.	5s 1951	94½	92½	97
Des Moines Elec.	5s 1938	99	98	100½
Detroit Edison	5s 1933	101½	99½	102½
Detroit Edison	5s 1940	102½	99½	102½
Detroit Edison	5s 1949	100½	97½	101½
Detroit Edison	5s 1955	100½	99½	100½
Detroit Edison	6s 1932	m139	....	....
Detroit Edison	6s 1940	107½	106½	109½
Detroit Edison	7s 1928	m134	....	....
Detroit Edison	7s 1929	m138½	....	....
Detroit Edison	7s 1930	m134	121½	158½
Dominion Pwr. & Trans.	5s 1932	95½	95½	98
Driver-Harris	8s 1931	96	88	97
Dubuque Elec.	6s 1942	101½	97½	102
Duke-Price Pwr.	6s 1949	102	98	103
Duquesne Lt.	6s 1949	106½	104½	107½
Duquesne Lt.	5½s 1949	106½	104	106
Durham Pub. Serv.	7s 1949	100	97½	101½
EAST PENN. ELEC.	6s 1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	100	97½	100½
East. Tex. Elec.	5s 1942	k 95	....	....
Economy Lt. & Pwr.	5s 1956	99	96	99½
Edison Elec. Illum. of Boston (notes)	4½s 1928	99½	98	100½
Edison Elec. Illum. of Bkln.	4s 1939	93	89	95½
Edison Elec. Illum. (N. Y.)	5s 1995	103	99½	103
El Paso Elec.	5s 1932	k102	....	....
El Paso Elec.	5s 1950	95	95	96
Elec. Pwr. Corp. (Germany)	6½s 1950	86½	85½	88½
Elec. Refrigeration	6s 1936	k106	n104½	n107
Elmira Wtr., Lt. & R.R.	5s 1956	96	92½	97
Empire Dist. Elec.	5s 1949	91½	86½	93
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	99	96	100
FEDERAL LT. & TRAC.	5s 1942	94½	88	96½
Federal Lt. & Trac.	6s 1942	105½	96½	103
Federal Lt. & Trac.	6s 1954	93½	91½	94½
Florida Power & Light	5s 1954	93½	....	....
Florida Publ. Service	6s 1955	96½	96½	99
Florida Public Service	6½s 1949	99½	99	103
Ft. Smith Lt. & Trac.	5s 1936	76	76½	82½
Ft. Worth Pwr. & Lt.	5s 1931	99½	99	100½
GALVESTON ELEC.	5s 1940	90	86½	93½
General Elec.	3½s 1942	87½	83	90½
Georgia Carolina Pwr.	5s 1952	86½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	87	86½	90½
Ga. Ry. & Elec.	5s 1932	98½	98½	100½
Ga. Ry. & Elec.	5s 1949	92½	88	94½
Ga. Ry. & Pwr.	5s 1954	85	89½	96
Ga. Ry. & Pwr.	6s 1947	102½	100½	103½
Ga. Ry. & Pwr.	7s 1941	105	105	107
German Gen. Elec.	7s 1945	95½	92	96½
German Gen. Elec.	6½s 1940	94½	94	94½
Great Cons. Elec. Pwr. (Japan)	6½ 1950	k 85½	n 85½	n85½
Great Cons. Elec. Pwr. (Japan)	7s 1944	91½	87½	92
Great Falls Pwr.	5s 1940	102½	99½	103½
Great Northern Pwr.	5s 1935	99½	96	100
Great Northern Pwr.	5s 1946	99	95	99½
Great Western Pwr.	5½s 1955	98½	96	99½
Great Western Pwr.	6s 1949	102	100	102½
Great Western Pwr.	6s 1952	101½	99½	102½
HAMBURG ELEC.	7s 1935	k 94½	n 94	n 94½
Havana Elec. Ry., Lt. & Pwr.	5s 1954	93	85½	95½
Holtwood Pwr.	6s 1954	103½	100	104½
Houston Ltg. & Pwr.	5s 1931	99½	98½	101
Houston Ltg. & Pwr.	5s 1953	94	90½	95½
Houston Ltg. & Pwr.	5½s 1954	101½	97	102½
Hydraulic Pwr.	5s 1951	101	99½	101
Hydraulic Pwr.	5s 1950	101	100	103
IDAHO PWR.	5s 1947	96½	93	97½
Ill. Elec. Pwr.	6s 1943	102½	99½	103½
Ill. Pwr.	5s 1933	93½	93	95½
Ill. Pwr. & Lt.	5½s 1954	97½	97½	98½
Ill. Pwr. & Lt.	6s 1953	101½	100½	102½
Ill. Pwr. & Lt.	7s 1953	103	99	104
Ind. Elec.	6s 1947	98	96	99½
Ind. Gen. Serv.	5s 1948	97	92	97½
Ind. Lighting	4s 1958	82½	78	84
Indiana & Mich. Elec.	5s 1957	99	97½	99½
Indiana & Mich. Elec.	5s 1955	95½	95	98
Ind. Pwr.	7½s 1941	m105½	104	106
Ind. Service	5s 1950	90½	86½	92
Ind. Service	6s 2020	84½	73	88½
Ingersoll-Rand	5s 1935	100	99½	99½
Int'l. Power Sec.	6½s 1928	m 99½	97½	100
Interstate Elec.	6s 1933	95	95	99½
Interstate Pwr.	6s 1944	97½	95	99½
Interstate Pwr.	7s 1934	101	97	101
Interstate Pub. Serv.	6s 1948	98½	96	100½
Iowa Ry. & Lt.	5s 1932	98½	97	99½
Iowa Southern Utilities	5½s 1950	95½	92½	97½
JERSEY CENT. PWR. & LT.	5½s 1945	95½	95½	98
KANSAS CITY PWR. & LT.	5s 1952	100½	95½	102
Kansas Elec. Pwr.	6s 1937	100½	97½	102
Kansas Elec. Pwr.	6s 1943	100½	97½	102
Kansas Gas & Elec.	6½s 1952	102	98½	103½
Kansas Gas & Elec.	6s 2022	92	86½	94½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Jan. 19. lBid, low, high, Wednesday, Jan. 20. mLatest quotations available. n1926.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Jan. 16	Low 1925	High 1925
BONDS (Continued)				
Kentucky Hydro Elec..	6s	1949	100⅛	99½ 101
Kentucky Utilities....	6s	1949	100⅛	97 101⅛
Kings Cty. Elec. L. & P.	5s	1937	102	99 103
Kings Cty. Elec. L. & P.	6s	1997	121	114⅛ 120⅞
Kings County Ltg.....	5s	1954	98	89 101
Kings County Ltg.....	6⅛s	1954	107	103⅛ 108
Knoxville Ry. & Lt....	5s	1946	94	88 95
LACLEDE GAS LT..	5s	1934	100⅜	98⅛ 101⅞
Laclede Gas Lt.....	5⅛s	1953	103½	95⅛ 103
Laurentian Pwr.....	6s	1936	100	96 100
Laurentide Pwr.....	5s	1946	99½	97 100
Lehigh Pwr. Sec. (notes)	6s	1927	n100⅛	n100⅛ n101⅛
Lincoln Gas & Elec....	5s	1941	93	91 95
Long Island Ltg.....	5s	1936	99½	98⅛ 100
Long Island Ltg.....	6s	1954	100	99⅛ 102
Long Island Ltg.....	6s	1948	105	102 105⅛
Los Angeles Gas & Elec.	5s	1939	100	98 101⅛
Los Angeles Gas & Elec.	5⅛s	1943	99	94 99
Los Angeles Gas & Elec.	5⅛s	1947	99	96 99
Los Angeles Gas & Elec.	5⅛s	1949	98⅛	95⅛ 99
Los Angeles Gas & Elec.	6s	1942	103⅛	101⅛ 104
Louisiana Pwr.....	6s	1944	98⅛	97 99
Louisville Gas & Elec...	5s	1952	98⅛	90⅛ 99
Louisville Gas & Elec...	5⅛s	1954	102⅛	99 103⅛
Lower Austrian Hydro Elec.....	6⅛s	1944	87⅛	85⅛ 87
Luzerne Cty. Gas & E..	5s	1948	98	97 99⅛
Luzerne Cty. Gas & E..	7s	1944	104⅛	99⅛ 104⅝
Luzerne Cty. Gas & E..	6s	1954	102⅛	99 105
MADISON RIV. PWR.	5s	1935	100⅛	99⅛ 101
Manila Elec.....	7s	1942	102	97⅛ 103
Manila Elec. Ry. & Ltg.	5s	1953	89⅛	85 92
Manitoba Pwr.....	7s	1941	k104	n103⅛ n104⅛
Memphis Pwr. & Lt....	5s	1948	99	95 99
Metropolitan Edison...	6s	1952	105	101⅛ 106
Metropolitan Edison...	5s	1953	97	91⅛ 97⅞
Metropolitan Pwr.....	6s	1953	103⅛	100 105
Michigan Lt.....	5s	1946	99⅞	97⅛ 100
Michigan No. Pwr.....	5s	1941	98	95⅛ 99
Milwaukee El. Ry. & Lt.	5s	1926	99⅛	99⅛ 101⅞
Milwaukee El. Ry. & Lt.	4½s	1931	98	94⅞ 97⅛
Milwaukee El. Ry. & Lt.	5s	1951	98⅛	94 100
Milwaukee El. Ry. & Lt.	5s	1961	91	84⅞ 92⅞
Milwaukee El. Ry. & Lt.	6s	1953	101⅛	98⅞ 104
Minn. Pwr. & Lt.....	5s	1955	95	95 97
Minn. Pwr. & Lt.....	6s	1950	104	101⅛ 105⅛
Miss Power.....	5s	1955	92	91 93
Miss. River Pwr.....	5s	1951	99	96⅛ 100⅛
Miss. River Pwr.....	7s	1935	102	102 104
Mo. Edison Elec.....	5s	1927	m99⅛	99⅛ 100⅛
Mobile Elec.....	5s	1946	97	91 98
Monongahela W. Pa. Public Service.....	5⅛s	1953	96	95 97⅛
Montana Pwr.....	5s	1943	100⅛	97⅛ 100⅛
Montgomery Lt. & W.P.	5s	1943	m 93	86⅛ 93⅛
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97 98⅛
Montreal Lt., Ht. & Pwr.	5s	1933	99⅛	98⅛ 101
Montreal Pub. Serv....	5s	1942	94⅛	89 94⅛
Mountain States Pwr..	6s	1938	99	96⅛ 100⅛
NASHVILLE RY. & LT.....	5s	1953	97⅛	94 99
Nashville Ry. & Lt....	5s	1958	91	84 92
Nassau Lt. & Pwr.....	5s	1927	99⅛	98 101
Nassau & Suffolk Ltg..	5s	1945	90	82 91
National Elec. Power...	6s	1945	93	92 97
National Pwr. & Lt....	7s	1972	102⅛	97 104⅛
National Pub. Serv....	6⅛s	1955	93⅛	94 97
Nebraska Pwr.....	5s	1949	99⅛	97 100
Nebraska Pwr.....	6s	2022	94	89⅛ 97
Nevada-Calif. Elec.....	6s	1946	99	96⅛ 100⅛
Nevada-Calif. Elec.....	6s	1950	99	96⅛ 100
New Brunswick Pwr....	5s	1937	81⅛	81 82⅛
New England Pwr.....	5s	1951	101⅛	100⅛ 103
New Jersey Pwr. & Lt.	5s	1936	97	92⅛ 97⅛
New Orleans Pub. Serv.	4½s	1935	87	83⅛ 88
New Orleans Pub. Serv.	5s	1952	91⅛	89⅛ 92
New Orleans Pub. Serv.	5s	1955	91	88⅛ 92⅛
New Orleans Pub. Serv.	6s	1949	90⅛	86⅛ 93
N.Y. & Queens El. L. & P.	5s	1930	102⅛	99⅛ 101
N.Y. & Westchester Ltg.	4s	2004	89⅛	76 81
N.Y. & Westchester Ltg.	5s	1954	97⅛	93 98⅛
New York Edison.....	6⅛s	1941	115⅞	112 115⅞
New York Edison.....	5s	1944	103	99⅛ 102
N.Y. Gas & El. L., H. & P.	5s	1948	104	100⅛ 104⅛
N.Y. Gas & El. L., H. & P.	4s	1949	89⅛	86 90
N. Y. State Gas & Elec..	5⅛s	1962	100⅛	96 101
Newport News & Hampton Ry., Gas & Elec...	5s	1944	88⅛	84 93
Niagara Falls Pwr.....	5s	1932	101⅛	99⅛ 103
Niagara Falls Pwr.....	6s	1932	105⅛	103 106⅛
Niagara Falls Pwr.....	6s	1950	105⅛	105⅛ 106⅛
Niagara, Lock. & Ont.	5s	1954	m 98⅛	104⅛ 110
Niagara, Lock. & Ont.	5s	1955	99⅛	97⅛ 100
Niagara, Lock. & Ont	6s	1958	m109⅛	104⅛ 110⅛
Norfolk Ry. & Lt.....	5s	1949	95	93 96
No. Amer. Edison.....	6s	1952	103⅛	96⅛ 104⅛
No. Amer. Edison.....	6⅛s	1948	105⅛	100⅛ 106
No. Amer. Lt. & Pwr...	7s	1954	99⅛	97 100⅛
North Caro. Pub. Serv.	5s	1934	91⅛	89 93⅛
North Caro. Pub. Serv..	6s	1954	94	91⅛ 96
North Caro. Pub. Serv...	6⅛s	1944	99	96 100
North Shore Elec.....	5s	1940	99⅛	97⅛ 100
No. Calif. Pwr.....	5s	1948	100	98⅛ 100⅛
No. Ind. Gas & Elec....	5s	1952	99	97 100⅛
No. Ind. Gas & Elec....	6s	1952	102⅛	99⅛ 103⅛
Northern N. Y. Utilities	5⅛s	1949	100	96⅛ 100⅛
No. Ohio Trac. & Lt....	4s	1933	87	82 87⅛
No. Ohio Trac. & Lt....	5s	1956	83	78 87
No. Ohio Trac. & Lt....	6s	1926	99	98⅛ 100
No. Ohio Trac. & Lt....	6s	1947	95⅛	91 97
No. Ontario Lt. & Pwr..	6s	1931	100	95⅛ 100⅛
No. States Pwr.....	6⅛s	1933	129⅛	105⅞ 141
No. States Pwr. (notes).	6⅛s	1933	103⅛	99⅛ 104⅞
No. States Pwr.....	6s	1948	102⅛	101 104⅛
No. States Pwr.....	6s	1941	105⅛	103 107⅛
No. States Pwr.....	5s	1941	98⅛	93 99⅛
No. Tex. Elec.....	5s	1940	70	72 82⅛
Northwestern Elec.....	6s	1935	102	101⅛ 102⅞
Northwestern Pub. Serv.	6⅛s	1948	99⅛	97⅛ 100⅛
Nova Scotia Tramways & Power.....	5s	1946	88	84 89
OHIO PWR.....	5s	1952	93⅜	89⅛ 96
Ohio Pwr.....	6s	1953	103⅛	101 104⅛
Ohio Pwr.....	6s	2024	95⅛	88 95⅛
Ohio Pwr.....	7s	1951	105⅞	105⅛ 107⅛
Ohio Pub. Serv.....	5s	1954	92	87 93
Ohio Pub. Serv.....	6s	1953	100⅛	99 101⅛
Ohio Pub. Serv.....	7⅛s	1946	112⅜	108 112⅛
Ohio Pub. Serv.....	7s	1947	110⅛	107⅛ 111⅛
Ohio River Edison.....	6s	1948	102⅛	98 104
Okla. Gas & Elec.....	5s	1950	92⅛	91⅛ 95
Okla. Gas & Elec.....	6s	1940	95⅛	95⅛ 98⅛
Ontario Pwr. of Niagara Falls.....	5s	1943	100⅛	98 100⅞
Ontario Transmission...	5s	1945	99⅜	97 99⅜
Ozark Pwr. & Wtr.....	5s	1952	76	75 79
PACIFIC COAST PWR.....	5s	1940	99	98 100
Pacific Gas & Elec.....	5s	1942	98	93⅛ 99
Pacific Gas & Elec.....	5s	1955	m93⅛	94 95⅛
Pacific Gas & Elec.....	5⅛s	1952	101⅛	99⅛ 102⅞
Pacific Gas & Elec.....	6s	1941	106⅛	103⅛ 107
Pacific Lt. & Pwr.....	5s	1942	99⅜	98⅛ 100⅜
Pacific Lt. & Pwr.....	5s	1951	99⅛	98 101⅛
Pacific Pwr. & Lt.....	5s	1930	99⅛	98 100
Pacific Pwr. & Lt.....	5s	1953	m96⅛	....
Parr Shoals Pwr.....	5s	1952	94	92⅛ 97
Paterson & Passaic G. & E.	5s	1949	100	96 100⅛
Penn Central Lt. & Pwr	6s	1953	103⅛	102 104⅛
Penn Edison.....	5s	1946	96⅛	93⅛ 97⅛
Penn Elec.....	6⅛s	1954	96⅛	96 99⅛
Penn. Elec.....	6s	1955	92⅛	91⅛ 95
Penn.-Ohio Edison.....	6s	1950	k105⅛	n98⅛ n105⅛
Penn Ohio Elec.....	6⅛s	1938	107	99⅛ 106
Penn Ohio Pwr. & Lt...	5⅛s	1954	98⅛	95 99⅛
Penn Ohio Pwr. & Lt...	6s	1939	98⅛	94 99⅛
Penn Pwr. & Lt.....	5s	1952	98	95 98⅛
Penn Pwr. & Lt.....	5s	1953	98	95 98⅛
Penn Pwr. & Lt.....	6s	1953	104⅛	102⅛ 105⅛
Penn Pwr. & Lt.....	7s	1951	105⅞	105⅛ 107
Penn Pub. Serv.....	5s	1954	95⅞	93 96⅛
Penn Pub. Serv.....	6s	1947	104	103 105⅞
Penn Wtr. & Pwr.....	5s	1940	101⅛	99⅛ 102⅛
Penn Wtr. & Pwr.....	5⅛s	1953	102⅛	100 103⅛
Phila. Co.....	6s	1944	104⅛	101⅛ 105
Phila. Co.....	5⅛s	1938	100	93⅛ 100
Phila. Co.....	5s	1951	96	93⅛ 97
Phila. Co.....	5s	1949	m 102⅛	94⅛ 104
Phila. Elec.....	6s	1941	c 107	106 108⅛
Phila. Elec.....	5s	1966	c103⅛	100 104⅛
Phila Elec.....	4s	1966	m85⅛	83 85⅛
Phila. Elec.....	5s	1960	c102⅛	100 104
Phila. Elec.....	5⅛s	1947	c107	103⅛ 107
Phila. Elec.....	5⅛s	1953	c107⅛	104⅛ 107⅛
Portland Elec. Pwr.....	6s	1947	99	96⅛ 100⅛
Portland Gen. Elec.....	5s	1935	99⅜	98⅛ 100⅜
Portland Ry., Lt. & Pwr.	5s	1942	89	84⅛ 92
Portland Ry., Lt. & Pwr.	6s	1947	99⅜	94 100⅛
Portland Ry., Lt. & Pwr.	7⅛s	1946	107⅛	104⅛ 108
Potomac Edison.....	6s	1949	99⅛	96 100⅛
Potomac Edison.....	6⅛s	1948	103	99 104
Potomac Elec. Pwr.....	5s	1929	j100	....
Potomac Elec. Pwr.....	5s	1936	j100	....
Potomac Elec. Pwr.....	6s	1953	j106	....
Potomac Elec. Pwr.....	7s	1941	j106⅛	....
Power Corp. of N. Y....	6s	1942	101	97 101⅛
Power Corp. of N. Y....	6⅛s	1942	104⅛	101⅛ 105⅛
Power Securities.....	6s	1949	k 78	....
Pub. Lt. & Pwr.....	5s	1945	69	64 79
Pub. Serv. Co. of Colo..	5⅛s	1954	94⅛	92 96
Pub. Serv. Co. of Colo..	6s	1953	98⅛	98 101
Pub. Serv. Co. of Colo..	7s	1933	101	98⅛ 102⅛
Pub. Serv. Corp. of N. J.	5s	1959	104⅛	103⅛ 105⅛
Pub. Serv. Corp. of N. J.	6s	1944	100⅛	95 100⅛
Pub. Serv. Co. of No. Ill.	5s	1956	97⅛	91 98
Pub. Serv. Co. of No. Ill.	5⅛s	1962	102	96⅛ 102⅞
Pub. Serv. Co. of No. Ill.	5⅛s	1964	102	96⅛ 102⅛
Pub. Serv. Co. of Okla...	6s	1949	99	97⅛ 101
Pub. Serv. Elec. & Gas..	5⅛s	1959	105	98⅛ 105⅛
Pub. Serv. Elec. & Gas..	5⅛s	1964	104⅜	99⅛ 105
Public Utilities (Ind.)..	6s	1929	100	99 100
Puget Sound Pwr.....	5s	1933	98⅛	98⅛ 100⅛
Puget Sound Pwr. & Lt.	5⅛s	1949	99⅛	96⅛ 100⅛
QUEBEC PWR.....	6s	1953	102	98⅜ 102⅛
Queensborough Gas & E.	5s	1952	99	96⅛ 100⅛
Queensborough Gas & E.	6s	1953	104⅛	101 105⅛
RHINE-WESTPHALIA ELECTRIC PWR...	7s	1950	k94⅛	n93⅛ n94⅛
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	93⅛	85 94⅛
Robbins & Myers.....	7s	1952	61	57⅛ 73
Rochester Gas & Elec....	5⅛s	1948	105⅛	102⅛ 105
Rochester Gas & Elec....	7s	1946	113	110 112⅜
Rochester Ry. & Lt.....	5s	1954	100⅛	99 101⅛
Rockford Elec.....	5s	1939	99⅛	98 101
ST. MAURICE PWR.	6⅛s	1953	108⅛	107 109
St. Paul Gas Lt.....	5s	1944	100⅛	98⅛ 101⅛
St. Paul Gas Lt.....	5⅛s	1954	101⅛	98 102⅛
St. Joseph Ry., Lt., Ht. & Pwr.....	5s	1937	91	85⅛ 93
Salt River Valley Wtr...	6s	1938	k100	....
Salmon River Pwr.....	5s	1952	101⅛	98⅛ 101⅛
San Antonio Gas & Elec.	5s	1949	96⅛	96 98⅛
San Antonio Pub. Serv..	6s	1952	101⅛	99⅛ 104
San Diego Cons. G. & E.	5s	1939	100	98 101
San Diego Cons. G. & E.	6s	1939	101⅛	99 103
San Joaquin Lt. & Pwr..	5s	1945	98⅛	98 100
San Joaquin Lt. & Pwr..	6s	1950	102	101 103⅛
San Joaquin Lt. & Pwr..	6s	1952	101⅛	99⅛ 103
San Joaquin Lt. & Pwr..	6s	1954	101⅛	99 101
Sauda Falls.....	5s	1955	k95⅛	n94⅛ n95
Savannah Elec. & Pwr..	7⅛s	1941	k104⅛	....
Saxon Pub. Wks. (Germany).....	7s	1945	93⅛	90⅛ 94⅛
Scranton Electric.....	5s	1937	101⅛	99⅛ 102⅛
Seattle Elec.....	5s	1930	100⅛	99⅛ 101
Seattle Elec.....	5s	1929	99⅛	99 100⅛
Seattle Elec.....	5s	1939	92	90 93⅛
Seattle Ltg.....	5s	1949	91⅛	85⅛ 93
Shawinigan Wtr. & Pwr.	5s	1934	100⅛	100 101⅛
Shawinigan Wtr. & Pwr.	5⅛s	1950	104	101⅛ 104⅛
Shawinigan Wtr. & Pwr.	6s	1950	105	104⅛ 106
Sheboygan Elec.....	5s	1946	95⅛	94 97
Siemens & Halske.....	7s	1928	k99⅛	n96⅛ n99⅛
Siemens & Halske.....	7s	1935	k95⅛	n94 n95⅛
Sierra & San Fran. Pwr.	5s	1949	76⅛	75 80
Sierra & San Fran. Pwr.	6s	1949	90	87 93⅛
Sioux City Gas & Elec..	6s	1947	101⅛	99 102⅛
Sioux City Gas & Elec..	6s	1949	101⅛	99 102⅛
So. Caro. Gas & Elec....	6s	1942	84	87 93
So. Caro. Gas & Elec....	6s	1932	75	78 88
Southeast Pwr. & Lt.....	6s	2025	90⅛	88 92
So. Cal. Edison.....	5s	1939	99⅛	99 101
So. Cal. Edison.....	5s	1944	96	92⅛ 97
So. Cal. Edison.....	5⅛s	1944	101	98⅛ 102
So. Cal. Edison.....	6s	1943	102⅛	100⅛ 104
So. Cal. Edison.....	6s	1944	104⅛	102⅛ 105⅛
So. Cities Utilities.....	8s	1931	98	99 102
Southern Colo. Power..	6s	1947	98⅛	93⅛ 99⅛
Southern Pwr.....	5s	1930	100	99 101
So. Public Utilities.....	5s	1943	99⅛	97⅛ 100⅛
So. Sierras Pwr.....	6s	1936	102⅛	102 104⅛
So. Utilities.....	6s	1933	102	97⅛ 102⅛
So. Wisconsin Pwr.....	5s	1938	91	88 93
Southwestern Gas & E.	5s	1932	95⅜	94 98
Southwestern Gas & E.	6s	1957	97	89 98
Southwestern Lt. & Pwr.	6s	1937	97⅛	94⅛ 99
Southwestern Power....	6s	1944	96⅛	96 98
Southwestern Pwr. & Lt.	5s	1943	94	90 97
Southwestern Pwr. & Lt.	6s	2022	92⅛	88⅛ 94⅛
Southwestern Pub. Ser..	6s	1945	94	94 99
Southwestern Utilities..	8s	1936	95	96 102
Springfield Ry. & Lt....	5s	1926	99⅜	98⅜ 100⅛
Standard Elec. of Cal...	5s	1939	98⅛	98⅛ 100⅛
Standard Gas & Elec...	6s	1935	99⅛	91 101
Staten Island Edison...	6⅛s	1953	106	104 107
Superior Water, Light & Power.....	4s	1931	94⅛	93⅛ 95
Syracuse Ltg.....	5s	1951	100⅛	97⅛ 101⅛
Syracuse Ltg.....	5⅛s	1954	103	100⅛ 103⅛
TAMPA ELEC.....	5s	1933	k 99	....
Tenn. Elec. Pwr.....	6s	1947	103⅛	99⅛ 104⅛
Tenn. Pwr.....	5s	1962	94⅛	90 96⅛
Tex. Pwr. & Lt.....	5s	1937	98	97 99⅛
Tex. Pwr. & Lt.....	6s	2022	94⅛	90 97⅛
Tide Water Pwr.....	6s	1942	99⅞	98⅛ 101
Tide Water Pwr.....	7s	1937	99⅛	97⅛ 101⅛
Toho Elec. Pwr. (Japan)	7s	1955	90⅛	87 91⅛
Tokyo Elec. (Japan)....	6s	1928	k97⅛	n97 n97⅛
Toledo Edison.....	5s	1947	99	97 100
Toledo Edison.....	7s	1941	109⅛	108⅛ 110
Toledo Gas Elec. & Htg.	5s	1935	96⅛	97 100⅛
Toledo Trac., Lt. & Pr. notes.....	5⅛s	1930	98⅛	97⅛ 100⅛
Topeka Edison.....	5s	1930	99	97 100
Topeka Ry. & Lt.....	5s	1933	94⅛	90⅛ 96⅛
Trenton Gas & Elec....	5s	1949	99⅛	98 100
Tri-City Ry. & Lt.....	5s	1930	98⅛	96⅛ 99⅛
Twin State Gas & Elec..	5s	1953	92⅛	84 94⅛
Twin State Gas & Elec..	5⅛s	1945	97⅛	96 98⅛
Tyrol Hydro-Elec. Pwr.	7⅛s	1955	95⅛	94⅛ 97
UJIGAWA ELEC. PWR.....	7s	1945	89	90 92
Union Elec. Lt. & Pwr.	5s	1932	101⅛	99⅜ 102⅛
Union Elec. Lt. & Pwr..	5s	1933	100⅛	98⅛ 101
Union Elec. Lt. & Pwr..	5s	1954	99	97⅛ 100
Union Elec. Lt. & Pwr..	5⅛s	1954	101⅛	100 104
United Elec. of N. J....	4s	1949	87⅛	85 89
United Elec. Lt. & Pwr..	4⅛s	1929	98	96 100
United Gas & Elec.....	6s	1945	100	96 101
United Lt. & Pwr. notes	5⅛s	1928	99⅛	98 100
United Lt. & Pwr.....	5⅛s	1959	96	90⅛ 97⅛
United Lt. & Pwr.....	6⅛s	1974	95⅛	92⅛ 97⅛
United Lt. & Rys.....	5s	1932	95⅛	92⅛ 97⅛
United Lt. & Rys.....	6s	1926	99⅜	100⅛ 101⅛
United Lt. & Rys.....	6s	1952	98	95⅛ 100⅛
United Lt. & Rys.....	6s	1973	89	87 92
United Pwr. & Lt.....	6s	1944	101⅛	99 103
United Water, Gas & Elec.....	5s	1941	93⅛	92 94
Utah Lt. & Trac.....	5s	1944	87	83⅛ 91⅛
Utah Pwr. & Lt.....	5s	1944	95⅛	91 98⅛
Utah Pwr. & Lt.....	6s	1944	103	102 104⅛
Utah Pwr. & Lt.....	6s	2022	92⅛	88⅛ 94⅛
Utica Elec. Lt. & Pwr...	5s	1950	100⅛	100⅛ 102⅛
Utica Gas & Elec.....	5s	1957	100⅛	98⅛ 103
Utica Gas & Elec.....	5⅛s	1949	103	101 103⅛
VERMONT HYDRO-ELEC.....	6s	1929	100	98⅛ 100⅜
Vicksburg Lt. & Trac...	5s	1932	91	89 93⅛
Virginian Pwr.....	5s	1942	93	88 96
Virginian Pwr.....	6⅛s	1954	102⅛	99 103⅛
Virginia Ry. & Pwr....	5s	1943	98⅜	93⅛ 99
Virginia-Western Pwr..	6s	1953	100⅛	100 101⅛
WAGNER EL. MFG.	7s	....	m101⅛	100 102
Washington Coast Util.	6s	1941	101⅛	99⅛ 102
Washington Ry. & Elec..	4s	1951	f 80	....
Washington Ry. & Elec.	6s	1933	j102⅜	....
Washington Wtr. Pwr..	5s	1939	101⅜	99⅛ 101⅛
West Penn Pwr.....	5s	1963	100⅛	93⅛ 100⅛
West Penn Pwr.....	5s	1946	100	93⅛ 100⅛
West Penn Pwr.....	5⅛s	1953	105⅛	100⅛ 106⅛
West Penn Pwr.....	7s	1946	106⅛	104⅛ 107⅛
W. Va. Lt., Ht. & Pwr	6s	1929	102	95 101⅛
West Virginia Utilities..	6s	1935	96	91 98
West Virginia Water & Elec.....	6⅛s	1942	102⅛	100 104
Westchester Ltg.....	5s	1950	103⅜	98 102⅛
Western Elec.....	5s	1944	100⅜	98 101⅛
Western N. Y. Utilities..	5s	1946	96⅜	90⅛ 97
Western Pwr.....	6⅛s	1954	100	97 101⅛
Western Publ. Service...	6s	1950	97	96 98⅛
West. States Gas & Elec.	5s	1941	98	95 99⅛
West States Gas & Elec. (notes).....	6s	1937	94⅛	94 97
West. States Gas & Elec.	6s	1947	99	97 100⅛
West. United Gas & El..	5s	1950	100	97 101
West. United Gas & El..	6s	1950	101	100 102⅛
Westphalia Un. Elec. Pwr.	6⅛s	1950	m87⅛	87⅛ 87⅞
Westinghouse El. & Mfg	7s	1931	106	105⅛ 108⅛
Wheeling Elec.....	5s	1941	97⅛	96 99
Wichita R. R. & Lt.....	5s	1932	84	83 88
Winnipeg Elec.....	6s	1954	95⅛	94 97⅛
Wisconsin Elec. Pwr....	5s	1954	98⅛	93⅛ 99⅛
Wisconsin Gas & Elec...	5s	1952	99	97 100⅛
Wis.-Minn. Lt. & Pwr...	5s	1944	95⅛	93 96⅛
Wisconsin Pwr., Lt. & Ht.	5s	1946	92	87 93
Wisconsin Publ. Service.	6s	1952	101⅛	99 102⅛
Wis. Ry., Lt. & Pwr....	5s	1933	92⅛	87⅛ 93⅛
Wis. River Pwr.....	5s	1941	91	88 92⅛
Wolverine Pwr.....	7s	1943	100	99 101⅛
YADKIN RIVER PR.	5s	1941	98⅜	96⅛ 99⅛
Yarmouth Lt. & Pwr....	5s	1937	83	82 87
Yarmouth Lt. & Pwr....	8s	1951	98	97 103

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, Jan. 19. *l*Bid, low, high, Wednesday, Jan. 20. *m*Latest quotations available, *n*1926.

Manufacturing and Markets

Trade Associations and Statistics

Evolution of American Business Described—Data Which Can Be Easily Compiled Are Discussed in Detail—Facts Are the Lifeblood of Commerce

By Alfred E. Waller
President Electric Power Club

IN A RECENT address before the Chamber of Commerce of New York, President Coolidge defined true business as "the mutual organized effort of society to minister to the requirements of civilization." This is a broad definition of business. It is also a definite indication of the direction which business evolution should take in order to receive the full support and approval of the government. The case of the public is stated in a few words. The need for organized effort on the part of business—a need which was not recognized until recently—is admitted. It is declared to be necessary, provided the object is to promote general welfare. This statement, taken with other like admissions and developments of the past year, is a long step forward in the relations of business with the public.

Organized effort is as old as business itself. For centuries there have been guilds, combinations and trade associations. Some of these were good and some otherwise. It was because in many cases the objects of organized effort were selfish and resulted in oppression and restraint that combinations of all kinds fell into disrepute. A series of mergers and a long period of business activities which resulted in expense and discomfort to the public was followed by the enactment of the Sherman law.

Sherman Law Was Ambiguous

Great difficulty has been experienced in defining what comes within the prohibitions of the Sherman law. Much of the controversy, which has been bitter and acrimonious at times, is owing to the fact that the language of the law is ambiguous. Part of the ambiguity is due to the manner in which the law was drafted and part to the fact that certain words which it was necessary to use in the drafting are usually associated by the public with ideas which are not what the writers wished to convey. Popular feeling ran high at the time this law was drafted and passed by Congress. There was no consideration given, apparently, to the fact that the law might be so worded as to be too broad and too inclusive. The desire of the Congress, reflecting that of the public, was to make a law so broad and inclusive that no possible combination would be tolerated. The fact that certain combinations might be beneficial and even desirable was not taken into account.

It is important to realize the general conditions and the political aspect which existed when the Sherman law went into effect. They account for the sweeping nature of its provisions. At a time when the attention of an exasperated public was focused on the desire to eliminate anything which might restrain its action it is a foregone conclusion that no legislator would intercede in behalf of any organized effort or any business association, even though, in his own opinion, their object and action might be desirable. It was in this manner that the restraint under which the public had chafed, doubtless some of it quite unreasonable, was transferred to the shoulders of business, and thirty-five years of experience has been required to bring about a suitable readjustment.

"Rule of Reason" Applied

As in the case of the public, business suffers when subjected to unreasonable restraint. It is now admitted that, if literally interpreted, the Sherman law constitutes unreasonable restraint of business. In fact, if applied without reservations or consideration of individual cases, it would definitely cripple business activities. In 1911 the Supreme Court of the United States promulgated what is known as the "rule of reason" in relation to the Standard Oil and the tobacco cases. This "rule of reason" states, in effect, that there are certain common-law analogies which may be applied by the judiciary in order to determine whether any particular contract or combination is oppressive and undesirable.

The "rule of reason" produced almost as much discussion and dissension as the original Sherman act. It had its defenders and its detractors. One group hailed the "rule of reason" as a common-sense method by which the sound fundamental ideas of the Sherman law might be applied. Another group contended that the courts were not qualified to determine the wisdom or undesirability of contracts or combinations by means of the common-law analogies in question. In their opinion it placed too much power and responsibility in the courts.

With a condition of uncertainty such as this existing, trade associations and those responsible for their direction were uncertain what activities might be carried on without laying the associations open to prosecution for action in restraint of trade. Naturally, activities of statistical nature—and, in fact, any activities which might appear to have any influence upon the costs, selling prices or distribution of commodities—were discontinued. This interruption of the normal and proper functions of trade organizations gradually had its effect. The need for reasonable stabilization of business through the collection and dissemination of industry statistics became more and more recognized. Following the adverse attitude of the Roosevelt, Taft and Wilson administrations toward trade association activities, there came a reaction to which voice was given early in 1924 by Mr. Stone, who was then Attorney-General. At that time he recognized that most trade associations were operating along lines which are entirely lawful and beneficial to the public. Others, in his own words, "are groping in the twilight zone of illegality, a few are wholly illegal."

Gathering Statistics Approved

It was not until the famous cases of the Cement Manufacturers' Protective Association and the Maple Flooring Manufacturers' Association were handed down by the Supreme Court last June that the growing reaction from the too restrictive applications of the Sherman act took definite form. It is common knowledge that these decisions give approval to an immense expansion of trade association activities, particularly as regards participation in the collection and distribution of industry statistics.

Thus, the interesting history of business in its relations to the public during this period may be summarized as follows: Complete lack of supervision or restraint by the public resulted in public inconvenience. In order to eliminate this inconvenience and discomfort the public imposed undue restraint upon business. The gradual realization of the undesirable effect of this restraint has been followed by what is in reality a permission to make constructive and unselfish use of the opportunities afforded by group action.

Undue Restraint Reacts on Public

Action and reaction are cyclical. The history of business development during the past fifty years shows plainly that if undue restraint is placed upon one party by another, the result is a reciprocal oppression as soon as events shape themselves in such manner as to make it possible.

It would seem but reasonable, therefore, to expect that intelligent interpretation of the past should demonstrate the necessity and desirability for unselfish and concerted action to "minister to the requirements of civilization" and to reap such reward as the effort may render suitable. It cannot be too strongly emphasized that the new opportunities which have been opened to business, and particularly to the trade organizations whose duty it is to develop business, are not a free license to carry on activities which may result in restraint of trade. Any tendency toward exploitation will inevitably be followed by sternly repressive measures.

It will not be difficult to guide statistical activities in a manner calculated to benefit business and the public as

well. The decisions are explicit. They set forth at least two interesting and fundamental ideas. The first is that organized effort which is fair, open and not intended to take advantage of any one is permissible and desirable. The other is that organized effort will be judged, not by what some one may conceive to be its intent, but by the results which it achieves. It augurs well for the future that such actions as may be taken within the scope of these limitations are acknowledged to be for the public good. A tremendous responsibility devolves upon every business unit and every trade organization in the strict observance of these fundamental limitations. It is far easier to point out a transgression to the public than to explain the good which it may have derived as a result of organized effort. A large number of trade organizations might function in a beneficial and proper manner, but if only a few carry on unfair practices, the condemnation of their action will include the innocent as well as the guilty.

WIDE FIELD FOR ASSOCIATIONS

Trade associations may now proceed with confidence in a large field of legitimate activities. There is no reason for confusion and no danger of gravitating into illegal activities, provided a few fundamental principles are constantly observed. One paragraph of the recent court decisions which has been frequently quoted deserves repetition at this point, for it states concisely the essentials of the situation: "We decide only that trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal point of shipment to the points of consumption, as did these defendants, and who, as they did, meet and discuss such information and statistics, without, however, reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce."

ACTIVITIES MUST BE VOLUNTARY

It will be noted that the reports of sales and prices must deal exclusively with past and closed transactions. It is necessary that the discussion of current market conditions for future price policies shall be avoided. This limitation, however, does not preclude the analysis of general business conditions and of the trend of prices. The other fundamental limitations are that such statistical data as are interchanged must not be arranged or published in such a manner as to identify any of the participating companies. All statistical data must be open to the public. All operations of this kind carried on through the medium of trade organizations must be entirely voluntary. Activities of any particular organization will be judged by the results which they bring about.

Granted that all these things are permissible and possible, why should they be undertaken? What benefit may be derived to offset the expense incidental to their operation? These and other similar questions are best answered by examining critically, item by item, the statistical work of which the courts approve. As much work of an educational and preparatory nature must be done before certain items can be collected and published, it is profitable to consider first the data which may be compiled with the least effort. Among these are total shipments and stocks on hand. Every company can compute the value of its shipments during a certain period and the value of its stock on hand at any given date.

Suppose each one of a group of companies which manufacture the same kind of equipment or material send a memorandum to a compiler each month giving the total amount of sales during the month and stock on hand at the end of the period. From these memoranda the totals for the industry are computed, and the memoranda are then returned to the point of origin. The totals are published and are available to all. After they have been charted for six months or a year their real value becomes more apparent. If sales are steady and stocks are increasing, a tendency toward overproduction is evident. Each contributing company can figure its own relation to the total and compare the trend of its own operations with the average for the industry. It is clear that information of this kind is valuable, whether it is considered as a basis for company policies or as an aid to the judgment of those who direct the policies. Much good and no harm may come of them. The only objections which have been raised to the collection and use of these data have been based on misunderstandings or misinformation. There is no valid reason why they should not be undertaken.

AVERAGE COST DATA VALUABLE

The question of the publication of costs appears to be the storm center. It is contended that any manufacturer's cost on a standard article is exclusively his own affair. This is undoubtedly true. There is no reasonable basis upon which this question may be disputed. Both legally and ethically, any manufacturer's cost on a particular item is confidential information and should be known to him alone.

It is claimed that if average industry costs upon any particular articles were published they would serve as a guide and landmark to different people in the industry who do not know their own costs, either through carelessness or lack of ability to determine what they are. This is true. An average industry cost on any particular standard article would be a guide, but too many people overlook the fact that it would also be a warning. Any manufacturer who could not come within a reasonable percentage of the average industry cost would be faced by one of two alternatives. If his cost is high, it behooves him to ascertain the reason. If his cost appears to be exceedingly low, he may well suspect that his accounting methods are not so efficient as they should be. If, as is permissible, the highest cost, sent in for compilation, and also the lowest are published as well as the average—all, of course, unidentified—then the value of cost statistics to every unit of the industry becomes even more apparent.

It is not proposed to publish industry costs on any article or articles for altruistic reasons. The industry is under no obligation to lend its experience for the purpose of keeping certain organizations or individuals from bankruptcy. There is no obligation expressed or implied to assist in keeping alive a competitor whose object is to take away one's business by methods of destructive competition. Tangible value accrues to an industry which publishes its costs, not because the weaklings are assisted, but because proper cost statistics will vastly assist in preventing those who are doomed to failure from impairing the market in which they had hoped to compete. When authentic data are practically non-existent, it is obvious that rumor and speculation must take their place, and it has often been demonstrated that unwise commercial policies are contagious. When there are no facts at hand, the first man to make a definite motion is apt to be hailed as a leader. The action of only a few companies will sometimes suffice to establish ruinous policies. Always there are wars and rumors of war, and in the absence of definite information the ablest business man can do no more than use his best judgment based on such reports as are available.

FACTS ARE NEEDED

If each year a large amount of money were to be awarded for the world's record in an athletic event and no facts regarding the record were published, there would be all manner of entrants, many of whom would have not the slightest chance of success. It is not in any way departing from strict analogy to say that the basic costs of standard articles in American industry are, so far as we are concerned nationally, a world's record. They are to be attained only by industry and application backed by experience and engineering genius. The task of producing any standard article at a price which will compete in the present American market is not lightly to be undertaken. Any work which is a combination of the best efforts of trained and experienced men backed by organizations built up through years of patient effort is not to be equaled or surpassed by amateurs. Therefore let the facts be known. It must be emphasized that whereas an individual cost is one man's business only, the average cost of the largest possible number of representative manufacturers should be a very important part of the business of each one.

BENEFITS OUTWEIGH RISK

How are these apparently divergent ideas to be reconciled? Is it possible to obtain an average figure for publication without giving dangerous or undesirable publicity to confidential facts? Surely this last question answers itself in the affirmative. Every firm tells its banker facts of equal or greater importance and feels secure in the knowledge that the information will not be divulged. Every individual confides all manner of private matters to his doctor or lawyer. Probably no commercial items are considered more confidential than costs. Costs change constantly;

they are affected by a large number of factors familiar to all who handle them. In the highly improbable case that a compiling agency might divulge an individual cost it is obvious that discovery would follow and a suitable remedy would be applied. The figure or figures divulged would soon become obsolete. It is difficult to believe that any lasting hardship would result in this extreme contingency, and it is unreasonable to contend that there is any real difficulty about properly safeguarding the means and method of collecting and disseminating information. The worst damage which could result would be less than might readily occur today if one firm were to hire a cost clerk employed by another. As against this negligible risk, consider the benefits which flow from the use of accurate data as a basis for business policies and operation. Conscious evolution is possible only when facts are available.

Facts Lifeblood of Commerce

Business operations flourish or decline according to the extent that accurate information is intelligently used in their direction. Facts are the lifeblood of commerce, and most of the failures which occur in all lines of business are due to a lack of information or to its unintelligent use. There is no way to obtain the fundamental data of any industry except by group action. There are no committees, agencies or individuals which can furnish the facts which are needed for the efficient direction of a business, but it is very simple and safe for the industry to compile its own information.

It is first necessary for each group of manufacturers who build the same kind of apparatus to decide what items are of interest and which are to be collected first and at what intervals. The manner in which the reporting is done and the choice of an individual to do the necessary compiling and computing depend to some extent upon the nature and quantity of the work to be done. There is no real difficulty in arranging to have all information used in the compilation kept absolutely confidential, and, as has been suggested, all the original information sheets may, and probably should be, returned to the senders. Out of these simple processes proceed facts which harm no one and which are of incalculable value to the business of the nation and consequently to all within it.

Broad Significance of Statistics

The broader significance of industry statistics and their effect upon the whole business structure may well claim our careful consideration. The reciprocal nature of the benefits derived by the different sections of an industry is duplicated by the major divisions of the nation's business. One small group may derive more benefits from the statistics of another group than from the data it compiles within itself. In the same way, one major division will gain much from the data of another related division. It is for this reason that industry statistics should be open to all, and each subdivision should contribute what it can to the general store of knowledge. Certain industries, because of their relation to and interdependence with a number of others, have fundamental characteristics which correspond closely to those of the nation's business as a whole. These are the so-called key industries. The electrical industry, widely and intimately related to many others, should rank as one of the most accurate barometers when statistical activities have been fully developed.

Facts Will Replace Theories

It is particularly important to have as much information as possible regarding the interpretation and use of facts, when these have been collected. Facts are not easily obtained, and their mere possession is not a deliverance from business difficulties. It is evident that either faulty reasoning or a false premise will suffice to produce an incorrect conclusion. And it is only human for those who have certain facts in their possession to suspect bad faith when they review the business policies of another whom they err in believing to be equally well informed. An error of this kind and its consequences are much more easily prevented than repaired. Harmony and prosperity go hand in hand; they can develop only in an atmosphere of good faith. It is in the development of co-operation and good faith, which in turn make possible the team work necessary for intelligent business evolution, that trade associations find their most valuable and important field.

To recapitulate briefly, the collection and dissemination of industry statistics bring, first of all, a store of accurate and pertinent facts for business guidance. These replace theories and conjectures and eliminate unsound policies. They strengthen and stabilize markets. They build up good faith and promote harmony. They make for better banking relations. They bring about fuller co-operation and mutual understanding with the government. They bring business and the public together in the participation of "organized effort to minister to the requirements of civilization."

Much effort will be necessary to bring about the full development of statistical work, not because the business of the country has failed to realize and to appreciate its value, but because in such a vast fabric even the most effective and desirable movements come slowly to fruition. There is reason to believe, however, that the present opportunity has been so long desired and anticipated that its development will be unusually rapid and fraught with the most valuable results.

Business Conditions

MANUFACTURERS in the electrical industry are optimistic as to good conditions continuing for some time. There has been no let-up in the activity of industrial plants, buying is generally steady, and the continued receipt of inquiries indicates that the volume of business will not fall off. Central-station companies are placing orders for general supplies and are very active in the South. Negotiations covering the sale of generating equipment have not yet materialized, but manufacturers expect fairly large sales of such apparatus during the first half of this year. Transformer companies report that business shows a better trend than for the same period last year, and many inquiries have been received for large units. Electric refrigerator manufacturers are active and are beginning to place fairly large orders for motors.

In New England trade is spotty, and although there is a decline in industrial equipment sales and a lull in the movement of transmission-line and central-station supplies, a number of negotiations are under way and the outlook is good. Many inquiries are being received by manufacturers in the New York district from industrial firms and central-station companies for quotations on a diversified line of equipment, and in addition, present sales are active. In the Southeast line construction material for new transmission lines has been in especially good demand. Orders continue to be received in large volume from Florida, and present indications point to a very rapid expansion of central-station companies throughout Florida, Georgia and Alabama. On the Pacific Coast power-company purchasing has predominated, but lumber and other industrial companies have been buying in good volume. A shortage of snow in the Sierras may change present power-company construction programs in California.

Non-Ferrous Metal Prices Weak—Demand Good on Concessions

PRICES of virtually all non-ferrous metals have declined somewhat. No particular reason can be assigned for the weakness, as no change in consumption is evident, but it has probably been influenced by the easier trend in the London metal market and in the New York stock market. The volume of copper sales has been better than for more than a month, Monday and Tuesday being particularly active days. These large sales were brought about by the fact that a considerable number of buying orders had been waiting for booking at 14 cents, delivered, and when some of the large producers came down to this price on the days mentioned their offerings were quickly taken up. A good business was also done in the Middle West at 14¼ cents. In the East no seller was disposed to quote below 14 cents on any considerable ton-

NEW YORK METAL MARKET PRICES

	Jan. 13, 1926 Cents per Pound	Jan. 20, 1926 Cents per Pound
Copper, electrolytic	14.15	14.10
Lead, Am. S. & R. price	9¼	9¼
Antimony	24½	23½
Nickel, ingot	35	35
Zinc, spot	8.85	8.65
Tin, Straits	63	61¾
Aluminum, 99 per cent	28	28

Base copper price Jan. 20, 1926, 16 cents

nage, though 13.975 cents was the price on one or two attractive orders. After selling a satisfactory volume on Tuesday some producers revised their prices upward to 14¼ cents but were unable to sell at that level to any extent, and copper was available on Wednesday at 14 cents, though not so freely. Most of the orders have been for February-March delivery.

The lead market continues to be active, with current production about keeping pace with demand. The tendency to ask premium prices is perceptibly less. Very little January lead is available, but February lead is freely offered. Foreign demand for lead has improved somewhat, though the London price has not been affected much. The American Smelting & Refining Company continues its contract price of 9¼ cents, New York. Galvanizers have complained of poor business, but they have bought substantial tonnages of zinc in the last week, possibly attracted by the lower prices.

Many Inquiries in New York District—Sales Active

NUMEROUS inquiries are being received by manufacturers in the New York district from industrial firms and central-station companies for quotations on various kinds of materials, indicating a large volume of business in the near future. Sales are also active, two orders for cable totaling more than $300,000 having been placed. Four 1,000-kva. transformers were also purchased by a central-station company for serving a new industrial plant load. General industrial buying is steady, pronounced activity being noticeable among textile mills, especially those producing artificial silk. Companies engaged in the manufacture of such products have requested quotations for steam turbines ranging in size from 500 kw. to 3,000 kw. as well as for miscellaneous motors and other equipment.

The large number of building construction contracts filed in New York and northern New Jersey during the latter part of last year are reflected in jobbers' reports of an increasing volume of sales of materials for this class of work. Plans now under way for a new electric railroad terminal in New Jersey are expected to stimulate further the demand for all types of building construction material as well as provide a fair share of business for the project named. One jobber reports his present sales as being about equal to those of Dec. 1 and in steady volume.

Line Construction Material in Demand in Southeast

CENTRAL - STATION activities throughout the Southeastern territory are particularly brisk, very satisfactory orders having been placed for pole-line construction materials, watt-hour meters and distribution transformers. Among the orders for transmission-line material is one for approximately 800 creosoted pine poles for the Georgia Southern Power Company's line from Dublin to Milledgeville and Sparta. The demand for poles generally throughout the district is very good, with deliveries on a basis of four to five weeks. Very satisfactory orders for high-tension switching equipment are reported from Florida, together with orders for high-tension insulators, and while no turbine orders have been closed since the first of the year several good ones are in prospect. Present indications point to a very rapid expansion of utility companies throughout Florida, Georgia and Alabama.

Domestic refrigeration is receiving considerable attention and a number of campaigns by the larger central-station companies will be inaugurated within the next 60 days. Several large orders for "white way" lighting equipment are in immediate prospect, mainly from Florida. One manufacturer states that he has shipped into that state since Jan. 1 more than 200,000 ft. of parkway cable. Considerable activity is noted in the railway-signal equipment field. The Southern Railway will install automatic signal equipment on 208 miles of track and replace present signal apparatus on its Atlanta-Washington division for approximately 637 miles of track.

Trade in New England Spotty—Many Negotiations Under Way

A DECLINE in industrial equipment transmission-line and central-station supplies was noted in the electrical market throughout New England during the past week. An encouraging offset to this condition is recorded in the increasing volume of negotiations under way for a wide range of commodities and, furthermore, in the striking optimism that prevails with regard to the betterment of industrial conditions among mill centers. A strong trend toward economy in power charges is reflected in numerous inquiries concerning turbo-generators. The centralization and grouping of large power interests presage further extensions of transmission lines, and prospects for equipment sales, in both new and replacement orders, are encouraging.

Appliance sales are spotty but an interesting trend is reported by one manufacturer who records a strong tendency for early restocking, due to the heavy drain during the holiday season. Retail trade has slackened in most lines of electrical commodities with the exception of radio equipment, which is experiencing a remarkable rush in sales throughout this district. New building construction projects are expected to stimulate much activity in wire, armored conduit, fixtures and wiring devices. One prominent firm plans for a large increase in elevator power equipment installations on account of the numerous hotel and large apartment projects under way.

Power Company Buying Predominates on Pacific Coast

PURCHASES by power companies predominate on the Pacific Coast, and include such items as 850 poles, 1,500 cross-arms, 20,000 space bolts, 35,000 cross-arm braces, as well as special hardware. A pole contract for $100,000 is also reported from southern California. The amount of construction planned is indicated by inquiries for such material as 100 assorted pike poles, tool bags, pliers and splicing clamps in 50 lots each. The frozen storage situation is now a real worry on the Coast, for there is only 12 in. of snow at the summit of the Sierras as contrasted with a normal pack of 80 in. Heavy storms are predicted within the coming week, but without them some of the power-company construction programs may be paralyzed, as they were two years ago. One company alone has planned to spend $25,000,000 in 1926 construction.

Lumber mills in the Puget Sound district are buying motors in good volume. An order for about $4,000 worth of average-sized motors was placed for a plant at Port Ludlow, and it is reported that several requests for quotations on equipment will soon be made, including one for a large plant proposed at Longview. Sales of motors to industrial plants were particularly good, orders placed in Seattle amounting to about $10,000. Orders for eleven large power transformers are also expected to be placed by a central-station company before the end of the month.

Activities of the Trade

Large Demand for New Switchgear Made by Allis-Chalmers

Substantial orders have been placed recently by at least four central-station companies in the United States for Allis-Chalmers-Reyrolle ironclad switchgear such as is used in Great Britain. The Allis-Chalmers company has only recently acquired the rights to manufacture such equipment in this country. A substation using this switchgear is said to be already in operation.

The orders which have been placed include every type in which this equipment is now made—namely, in ratings up to 33,000 volts, 3,000 amp., and 1,500,000 kva. rupturing capacity. Equipment of this type has been used in Great Britain for 20 years. Based on surveys made last year, 65 per cent of all the switchgear used in that country is of the ironclad type, and five out of six superpower stations use such equipment.

Westinghouse Orders Show Increase Over Last Year

Orders booked by the Westinghouse Electric & Manufacturing Company for the quarter ended Dec. 31 are announced as amounting to $39,771,326. Orders booked during the same period last year amounted to $38,653,700. During the previous quarter ended Sept. 30 orders received amounted to $43,285,770. Total orders received by the company since April 1, 1925, when the present fiscal year began, amount to

$127,602,770, which compares with $113,390,000 for the corresponding period in 1924. Sales billed by the company during the quarter ended Dec. 31, 1925, amounted to $43,815,097, the largest volume of billings in any single quarter in years.

The company has recently received an order for five electric passenger locomotives and three switching engines from the New York, New Haven & Hartford Railroad. This order amounts to about $1,000,000.

Laundryette Announces New Executives and Directors

The Laundryette Manufacturing Company of Cleveland, maker of the "Laun-Dry-Ette" wringerless washing machine, has announced a number of changes in its executives and directors. C. S. Jennison is the new president, Paul K. Craig vice-president and secretary, and A. G. Cook will continue as treasurer. Mr. Jennison was formerly a partner of the George W. Goethals Company of New York, while Mr. Craig has for many years been engaged in various merchandising phases of the electrical industry.

The new board consists of Messrs. Jennison, Craig, T. B. Van Dorn, who is also a vice-president; R. J. Frackelton, Thomas Ferry, David M. Hough and Howard Converse. Messrs. Frackelton, Van Dorn and Ferry were formerly on the Laundryette board and are also identified with a number of other large manufacturing concerns in Cleveland. The new interests are formulating new plans and policies which are further expected to expand and develop the business.

The General Electric Company announces that, following the retirement of Maxwell Day, the marine engineering department of the company has been consolidated with the commercial department under the direction of D. W. Niven. Because the marine sales department has been responsible for all company negotiations with the various federal government departments, the name of the department has been changed, and it will be known hereafter as the federal and marine department.

The Lightolier Company, 569 Broadway, New York, manufacturer of lighting fixtures, has purchased the former Continental Candy Company's plant at Jersey City, occupying the block bounded by Claremont Avenue, West Side Avenue, Halstead Street and the Central Railroad of New Jersey tracks. The company will use the building for the manufacture, storage and distribution of its products.

The Simplex Electric Heating Company, Cambridge, Mass., manufacturer of electric heating devices, announces the appointment of W. A. Gardner and A. S. Reed as factory representatives and field service men for the New York metropolitan district.

The Drake Non-Clinkering Furnace Block Company, Inc., 5 Beekman Street, New York, announces the following changes in its sales organization: Alfred Campbell, formerly district sales representative in the Pittsburgh and Cincinnati territories, has been appointed general manager; Harry Baumgartner, formerly with the Public Service Electric & Gas Company at its Essex station, has been retained as refractory engineer, and D. B. Wilson has been appointed district sales representative in Philadelphia as well as being in charge of Baltimore and Washington territories.

The International General Electric Company has received a contract covering 8,000 lighting units for the street-lighting system in Santiago, Chile.

The Universal Metal Box & Products Company, Inc., 144 Bleecker Street, Newark, N. J., manufacturer of electric boxes and specialties, announces that the Fred Rall Company, Inc., 52 Warren St., New York City, has been appointed sales agent in the metropolitan district, which includes northern New Jersey.

The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, manufacturer of pole-line hardware, line material, lightning arresters, etc., announces the following appointments: C. V. Root will cover the Chicago territory in the interests of floodlighting; G. R. Scott will be representative for Minnesota, North Dakota, South Dakota, Iowa and eastern Nebraska; Charles J. Brickley will cover Wisconsin and upper Michigan.

The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, announces that it is now placing on the market the "Hotpoint superiron" with the new "Calrod" element. This new element, which is completely inclosed, is molded in solid cast iron. The company states that over 100,000 "Calrod" elements have been used in range circuit units, as well as in heavy-duty-cooking equipment and many different items of the "Hotpoint" line.

The Savage Arms Corporation, Utica, N. Y., announces that it is now placing on the market the domestic Savage all-electric ironer, having what is called the forearm typewriter touch control. The unit is of the portable shoe-and-roll type and uses a Westinghouse ⅛-hp. motor.

Stone & Webster, Inc., Boston, engineers, builders and utility operators, have acquired property in that city at Water and Kilby Streets, 60 ft. x 175 ft., and will have plans drawn at an early date for the erection of a fourteen-story building. The company has been maintaining headquarters at 147 Milk Street, as well as occupying space in a number of other buildings in that vicinity. All executive and engineering departments will be concentrated in the new structure.

The Electric Refrigeration Corporation, Detroit, announces that it has closed a contract amounting to $4,500,000 with one of the leading ice-cream manufacturers for electric ice-cream cabinets. The company also announces that it has just closed a contract with the Southern California Edison Company calling for the delivery of 2,500 "Kelvinators" during 1926.

The General Electric Company has received an order from the New York Central Railroad for electrical equipment for two Diesel-electric tugboats for operation in New York Harbor. The apparatus includes two 270-kw., 240-volt direct-current generators for each boat. One set of Diesel engines will be furnished by the Ingersoll-Rand Company and the other set by the McIntosh & Seymour Corporation. Control will be of the Ward Leonard type.

The Bartlett Hayward Company, 350 Madison Avenue, New York, announces that F. W. Thomas has been appointed direct representative for the sale of "Fast's" flexible couplings in the New York territory.

The Sangamo Electric Company, Springfield, Ill., manufacturer of watt-hour meters, instrument transformers, etc., will hold a four-day sales conference at Springfield, beginning Jan. 25.

The Transmission Tower Fabricating Company, Chicago, announces that George R. Hoffman has succeeded G. H. Trumann as president, Mr. Trumann having resigned on account of ill health. John P. Krauss, recently made vice-president and Milton Greenberger, secretary and treasurer, are now handling business in the Chicago district directly and not through an agent as heretofore.

The Westinghouse Electric & Manufacturing Company has received an order from the Brooklyn Edison Company for underfeed stoker equipment for the fourth extension of its Hudson Avenue generating station. The installation will consist of four stokers for use with four Babcock & Wilcox boilers of 2,261 hp. each.

The Independent Electric Machinery Company, Kansas City, dealers in new and used electrical machinery, announces that it will move to larger quarters at Southwest Boulevard and Central Street about Feb. 1. John E. Launder, president of the company, also said that the company would enter the manufacturing field upon moving to the new location. The site acquired is 75 ft. x 135 ft. and contains a three-story brick warehouse having 34,000 sq.ft. of floor space.

The Eureka Tool & Machine Company, 42 Walnut Street, Newark, N. J., manufacturer of time switches, coil winders, etc., announces that Edward W. Weiler, for six years in the machine development department of the Edison Lamp Works of the General Electric Company, Harrison, N. J., has joined the staff of the company.

The Griscom-Russell Company, manufacturer of evaporators, water heaters, oil and water coolers and steam specialties, announces the removal of its main office to 285 Madison Avenue, New York City.

J. H. Bunnell & Company, 32 Park Place, New York, manufacturer of telegraph and fire-alarm equipment and other electrical supplies, announces that control of the company has been acquired by J. J. Raftery and J. G. Dougherty. Mr. Raftery, formerly Eastern general manager of the Manhattan Electrical Supply Company, has been elected president and Mr. Dougherty, formerly connected with the Illinois steel Corporation, has been made vice-president and treasurer. Plans for enlarging the manufacturing department and for extension of the jobbing business are under development.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Alexandria, Egypt (No. 18,788), for pumping units for irrigation purposes. An agency is also desired (No. 18,772) for electrical appliances and for radio sets and parts.

Purchase is desired in Madrid, Spain (No. 18,733), for electric furnace for obtaining bismuth.

An agency is desired in London, England (No. 18,766), for electrical household appliances.

An agency is desired in Batavia, Japan (No. 18,733), for electrical jewelers' tools.

Purchase and agency is desired in Cornwall, Ontario, Canada (No. 18,752), for conveying machinery.

Purchase is desired in Kamloops, B. C., Canada (No. 18,801), for steam or motor-driven road-making shovel.

An agency is desired in Vienna, Austria (No. 18,758), for dishwashing machines and cutlery cleaners.

TRANSFORMERS AND AUXILIARY APPARATUS FOR MELBOURNE, AUSTRALIA.—Bids will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until March 29, for four 1,500-kva., single-phase, 50-cycle, oil-insulated, self-cooled, outdoor-type transformers and auxiliary apparatus for obtaining the neutral point. Copies of specifications are on sale at the New York and Chicago offices of the Bureau of Foreign and Domestic Commerce.

New Trade Literature

AIR COMPRESSORS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-233, describing its single-stage centrifugal air compressors. It contains an illustration giving the construction details of a single-stage air compressor, as well as curves showing operating characteristics.

CONDUIT SYSTEM.—"Murray Conduit Systems" is the title of a bulletin issued by Murray Conduit Systems, 55 Duane Street, New York. The bulletin describes Murray conduit as employed for the construction of underground electrical conduits and contains a list of organizations using the conduit. A description of the Murray conduit system as employed for electrical conduit installation in power generating stations, substations, industrial buildings and tunnels and subways is also included. Attention is also called to Murray underground accessories.

COPPER WIRE.—"Bare Copper Wire" is the title of a bulletin issued by the Rome Wire Company, Rome, N. Y., covering its various types of wire and cable, including bare copper transmission line and weatherproof wires and cables. It also contains a short sketch on wire gages. Information on measurements and gage data is included.

FEED-WATER HEATERS. — Bulletin No. 1,340 issued by the Cochrane Corporation, Philadelphia, describes and illustrates the Cochrane feed-water heaters of all types for steam plants, including open, metering, deaërating, steam-stack, vacuum, back-pressure or surface, jet-storage, hot-process softeners for boiler-feed, hot-water supplies to buildings or for processes and all other services requiring hot, deaërated or softened water.

EXHAUST STEAM VALVES, BLEEDER VALVES, ETC.—The Atwood & Morrill Company, Salem, Mass., is distributing catalog G, covering its exhaust steam valves, bleeder valves and accessories for turbine and condenser service and other "Twentieth Century" specialties for bleeding steam at very low pressure for the purpose of heating feed water and other valves. Several new types of condensate traps, float chambers and balanced free-flow check valves are included.

SWITCHBOARDS. — The Condit Electrical Manufacturing Company, South Boston, has issued publication No. 1006-2, entitled "Condit-Built Switchboards for Every Industry," covering the various types of the Condit switchboards. Illustrations are given showing typical installations in a number of plants. A description of the method of manufacturing the switchboards is included.

ELECTRIC HEAT.—"Electric Heat in American Industry" is the title of a pamphlet issued by the General Electric Company, Schenectady, N. Y., in which it calls attention to the service electric heat is performing in industry. Included in the pamphlet are several advertisements inserted in national magazines suggesting many ways in which electric heat can be used in manufacturing establishments.

OIL-TESTING METHODS.—The American Oil Burner Association, 350 Madison Avenue, New York City, has issued its Technical Bulletin No. 1, entitled "Testing Methods and the Importance of Tests in the Oil Burner Industry." in which it gives an outline of the considerations entering into the testing of oil-firing equipment, to establish a standard code by the application of which oil burners in conjunction with boilers may be tested, and contains tables covering the constants that have to do with oil combustion. Charts are also included to facilitate the visualization of the influence which varying factors have on each other.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FALL RIVER, MASS.—Plans are under way by the Montaup Electric Company to double its transmission facilities from Swanson Junction to Fall River and Blackstone Junction. A new steel tower line designed to carry two No. 2/0, three-phase, 115-kv. (present operation 66 kv.) circuits, will be built on the 5.9-mile route between Swansea Junction and Fall River. On the Blackstone Junction line, a second circuit 8.6 miles long, of No. 2/0 copper wire will be erected on the present towers. Material for this project has been ordered. Stone & Webster, Inc., Boston, are engineers. R. T. Branch is superintendent of construction.

ROWE, MASS.—The New England Power Company, Worcester, plans to build a local substation, to cost about $35,000.

DERBY, CONN.—Plans for the proposed new factory building to be erected by William Knorr, include a power plant.

HARTFORD, CONN. — Plans are being considered by the Police Department for the installation of an electric traffic signal system, to cost about $40,000.

Middle Atlantic States

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 10 for a fire-alarm system for the State Hospital at Binghamton.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 10, for a fire-alarm system for the Brooklyn State Hospital.

BROOKLYN, N. Y.—Plans are being prepared by Shampan & Shampan, engineers and architects, 188 Montague Street, for a power house for the Gold Seal Laundry Company, 962 Franklin Avenue, to cost about $165,000.

BUFFALO, N. Y.—The City Council is considering the installation of luminous arc lamps on Clinton, Elmwood, East Delavan, Lovejoy and Hertel Avenues.

BUFFALO, N. Y.—Bids will be received by the chairman, board of trustees, State Institute for the Study of Malignant Disease, Buffalo, N. Y., until Jan. 26, for construction, heating, sanitary and electric work of hospital building for the State Institute for the Study of Malignant Disease, Buffalo.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps, Procurement District, Governors Island, until Feb. 5, for telephone equipment, including 200 telephones, 400 coils, 1,000 condensers, receivers, switches, etc. (Circular 19). Also, until Feb. 1, for 50,100 ft. wire (Circular 21).

TUCKAHOE, N. Y. — The Westchester Lighting Company, Mount Vernon, plans to build an automatic substation on Main Street, to cost about $200,000.

VALATIE, N. Y. — Contract has been awarded by W. A. Harder for construction of a power house on the site of the old Beaver mill. The proposed plant will supply electricity for one of the Harder mills.

ALLENHURST, N. J.—The Eastern New Jersey Power Company, Asbury Park, contemplates erecting a 33,000-volt transmission line from Allenhurst to Belmar, to cost about $250,000.

BRADLEY BEACH, N. J.—Extensions and improvements to its local lighting system are contemplated by the Eastern New Jersey Power & Light Company, Asbury Park.

NEWARK, N. J. — The Weyerhaeuser Timber Company, 220 Broadway, New York, plans to install electric power equipment at its proposed lumber terminal at Port Newark, to cost about $500,000.

CANTON, PA.—The installation of a new street-lighting system throughout the village to replace the old lamps is under consideration by the Borough Council.

MILL HALL, PA.—Plans are under way by the Harbison-Walker Brick Company, Mount Union, for the construction of a factory, including power plant, pattern-making shop, etc., to cost about $150,000.

PHILADELPHIA, PA. — The Philadelphia Electric Company has acquired a site at Westmoreland and Fox Streets, on which it is proposed to erect a substation.

WEATHERLY, PA.—Extensions of the street-lighting system into the outlying sections of the village, to cost about $2,000, is under consideration by the Borough Council.

BALTIMORE, MD.—The Edward Katzinger Company, 1949 North Cicero Avenue, Chicago, plans to install electric power equipment in its proposed local plant at Fleet and Eighth Streets, to cost about $500,000.

OCEAN CITY, MD.—The officials of the Eastern Shore Gas & Electric Company, Salisbury, have decided not to rebuild the local plant, recently destroyed by fire, but plan to erect a 123,000-volt transmission line to supply electricity here and to communities along the line. The cost of the proposed line is estimated at $50,000.

OAK HILL, W. VA.—Plans are under way by the Fayette Utilities Company, recently organized, for the erection of a transmission line in this vicinity for coal-mining and other service. C. W. Dillon, Fayetteville, is interested in the company.

WHEELING, W. VA.—Steps have been taken by the Chamber of Commerce to secure the extension of the ornamental lighting system in the business district.

GROVE HILL, VA. — The uncompleted hydroelectric plant of the defunct Valley Power Company on the Shenandoah River at Grove Hill has been purchased by the Shenandoah River Power Company, Inc.

TAPPAHANNOCK, VA. — The Virginia Electric & Power Company, which recently acquired the local electric plant, plans extensions and improvements to the plant and system.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 2, for storage batteries for navy yards at Boston, Brooklyn, Philadelphia, San Diego, Mare Island and Puget Sound (Schedule 4913).

North Central States

BIG BAY, MICH.—The Lake Independence Lumber Company plans to install electric power equipment in connection with the rebuilding of its mill, recently destroyed by fire with loss of about $400,000.

JACKSON, MICH.—Contracts have been awarded by the Consumers Power Company for the construction of two hydro-electric plants on the Thornapple River, at Ada and Cascade, at a total cost of $352,000. The plant at Cascade will be equipped for automatic control.

LUDINGTON, MICH. — Plans for the proposed local lumber mill to be erected by the Sheldon Lumber Company, to cost about $100,000, include a power plant.

CHAGRIN FALLS, OHIO.—R. S. Graves, president and manager of the Chagrin Valley Electric Company, is in the market for transformers, power station equipment, etc.

CHILLICOTHE, OHIO. — The Fairfield Paper Company, Baltimore, Ohio, plans to install electric power equipment in its proposed local mill, to cost about $275,000.

DAYTON, OHIO.—Bids will be received by the Director of Public Service, City Building, until June 29, for building the main waterworks pumping station and ap-

purtenances. George F. Baker is director of public service.

HAMMONDSVILLE, OHIO.—Plans for rebuilding the clay-manufacturing plant of the F. S. Donado Fire Clay Company, recently destroyed by fire with a loss of about $50,000, include a power plant.

SALINEVILLE, OHIO.—The municipal electric plant has been acquired by the Ohio Power Company, Canton. The local plant will be closed down and electric service supplied from the transmission system of the company.

LOUISVILLE, KY.—Plans for the proposed oil refinery plant to be erected by the Louisville Petroleum Company, Inter-Southern Building, to cost about $700,000, include a large power plant. W. M. Mitchell is engineer for the company.

LOUISVILLE, KY. — Contract for the second unit of the Widows and Orphans' Home of the Kosair Temple, Nobles of the Mystic Shrine, consisting of a power house, superintendent's home and eight dormitories, to cost more than $550,000, has been awarded to Platoff & Bush, Louisville, contractors, who also have the contract for the first unit. Joseph & Joseph, Louisville, are architects.

STURGIS, KY.—The Kentucky Utilities Company, Louisville, which has acquired the property of the West Kentucky Electric Power Company, plans to build a large electric power plant on the Ohio River near Sturgis.

BRYANT, IND. — The Indiana Service Corporation, Indianapolis, which has purchased the properties of the Bryant Electric Company, the Wells County Electric Company, the Berne Electric Light Company and the Marion & Bluffton Traction Company, is planning to erect a transmission line in this vicinity.

FORT WAYNE, IND.—Plans are under way by the Indiana Service Corporation for the construction of a steam-operated electric power plant to cost about $150,000.

INDIANAPOLIS, IND. — The Indiana Wheat Growers' Association, plans to install electric power equipment in its proposed grain elevator in the Beech Grove section, to cost about $300,000. Herman Steen, Indianapolis, is secretary and treasurer.

CHICAGO, ILL.—The Dowst Brothers Manufacturing Company, 120 Ann Street, will install electric power equipment in its proposed toy factory on Fulton Street, to cost about $200,000. A. S. Alschuler, 28 East Jackson Boulevard, is architect.

CHICAGO, ILL.—A permit has been granted the Commonwealth Edison Company to erect a substation at Fillmore Street and St. Louis Avenue. Plans have also been filed for a substation at Lawrence Avenue and Crawford Street.

PEORIA, ILL.—The installation of an ornamental lighting system on Knoxville Avenue, covering about 2 miles, to cost about $25,000, is under consideration by the Board of Local Improvements. C. F. Barton is president of board.

GREEN BAY, WIS.—Plans are under way by the Wisconsin Public Service Corporation to extend its transmission lines to furnish electric service to farmers in the territory it serves in Northern Wisconsin. It is proposed to erect about 100 miles of rural lines, providing for about 400 rural consumers, at a cost of about $100,000.

MADISON, WIS.—A petition has been presented to the City Council by property owners on East Mifflin Street for the installation of ornamental lamps on that thoroughfare.

MARINETTE, WIS.—The City Council is considering a proposal submitted by the Menominee & Marinette Light & Traction Company offering to replace the street-lighting system in the downtown section with new lamps. The plans call for eighty-five lamps to be erected in this district.

PHILLIPS, WIS.—Plans have been prepared by the Flambeau Public Service Company, Park Falls, to extend its service lines to supply electricity to consumers in the outlying districts of Phillips.

POPLAR, WIS.—A proposal has been submitted to the Village Council by the Northern Wisconsin Hydro-Electric Power Company, Port Wing, offering to extend its transmission line and furnish electrical service here. Poplar has not electric service.

MINNEAPOLIS, MINN.—Plans are being prepared by P. E. Crossier, 915 New York Life Building, for extensions to the Eitel Hospital, Fourteenth and Willow Streets, including additions to clinic, to cost about $300,000; addition to hospital, with a power house, to cost $400,000, and nurses' dormitory, $150,000. G. C. Eitel is proprietor.

DAVENPORT, IOWA. — The Central States Power & Light Corporation, which has acquired the properties of the Arkansas Public Service Company, Southeast Missouri Public Service Company, and purchase the controlling interest in the Missouri Electric Power & Development Company, plans an expenditure of over $1,000,000 in connecting these properties with its own line and with those of the Northeastern Iowa Power Company, which it controls.

MARSHALLTOWN, IOWA.—The Fisher Governor Company plans to build an addition to the power plant at its local factory.

Southern States

AHOSKIE, N. C.—Improvements to the electric system are under consideration by the City Council.

BRYSON, N. C.—The City Council is considering an issue of $120,000 in bonds, of which $15,000 will be used for improvements to electric light and power system.

GREENSBORO, N. C.—Work has started on the erection of two transmission lines by the North Carolina Public Service Company, one 14 miles long, from Greensboro to Stokesdale and Summerfield, and one from Burlington to Alamance, between 4 and 5 miles in length, to serve small towns and industries in those districts.

HICKORY, N. C.—The Martin Furniture Company plans to build a power plant in connection with its proposed local furniture factory, to cost about $100,000.

ROCKY MOUNT, N. C.—The Virginia Power & Electric Company, Richmond, Va., has submitted a proposal to the Board of Aldermen for the purchase of the new municipal electric power plant, now under construction, and selling energy to the city for the municipal electric system.

WINSTON-SALEM, N. C.—A permit has been granted the R. J. Reynolds Tobacco Company for the construction of a building to house a supplementary electric power plant. J. E. Sirrine & Company, Greenville, S. C., are engineers.

KINGSTREE, S. C.—The South Carolina Power & Light Company, Charleston, is considering the installation of additional equipment in its local plant.

DOUGLASVILLE, GA. — The Georgia Railway & Power Company, Atlanta, plans to erect a 38,000-volt transmission line to Douglasville to furnish service here. Improvements will be made in the local electric system.

FORT LAUDERDALE, FLA.—The City Council is considering a bond issue of $3,875,000 for municipal improvements, of which from $500,000 to $750,000 will be used to build a municipal electric light and power plant.

FORT MEADE, FLA.—At an election to be held Feb. 9 the proposal to issue $180,000 in bonds for municipal improvements, including $40,000 for lighting purposes, will be submitted to the voters.

MIAMI, FLA.—The Florida Power & Light Company plans to extend its transmission lines to Miami Beach, Daytona and vicinity.

TAMPA, FLA.—Plans are under way by the Tampa Electric Company for the construction of a large power plant on the Alafia River, south of the city, with an ultimate output of 500,000 hp. The initial installation will have a capacity of 27,000 hp. The project will include a 16 ft. channel, 2½ miles long, from the plant site to deep water.

BIRMINGHAM, ALA.—The construction of a substation and branch transmission lines to Wedowee and Wadley from the nearest point on the Birmingham and Roanoke transmission line is contemplated by the Alabama Power Company.

DAPHNE, ALA.—Permission has been granted Jason Malbis, 951 Washington Avenue, Mobile, to erect a transmission line from Baldwin County plant to Daphne, a distance of 4½ miles.

MONTGOMERY, ALA.—Bids will be received by the City of Montgomery at the office of the City Treasurer until Feb. 16 for furnishing a 4,200-gal.-per-minute, direct-connected motor-driven centrifugal pumping unit. J. W. Billingsley, Interstate Bank Building, New Orleans, La., is consulting engineer.

TUNICA, MISS.—The House Light & Power Company, operated by the Mississippi Power & Light Company, Pine Bluff, Ark., is planning to erect a transmission line to Tunica.

BENTONVILLE, ARK.—Application has been made by the Southwest Power Company, McAlester, Okla., for a franchise to furnish electric service here.

GRAVETTE, ARK. — A. N. Walker, Aurora, Mo., and associates who have leased the municipal electric light plant are considering extensions and improvements to the local system.

SULPHUR SPRINGS, ARK. — Charles Page, Tulsa, Okla., recently granted a franchise plans to erect a temporary transmission line from Gravette to furnish electricity here.

CORDELL, OKLA. — Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system.

TALIHINA, OKLA. — The McCurtain (Okla.) Light & Power Company, which has been granted a franchise here, plans to build a local power plant, to cost about $50,000.

TUTTLE, OKLA.—A franchise has been granted the Chicasha (Okla.) Gas & Electric Company to supply electricity in Tuttle. The company plans to erect a high-tension transmission line from a point near Minco, 8 miles long, to serve Tuttle. It also contemplates the erection of a line connecting with the Minco line 3 miles south of Pocasset and extending eastward to Amber.

ABILENE, TEX.—The West Texas Utilities Company, Abilene, which has acquired the local electric plant at Junction, plans to extend its high-tension line to furnish service there. The company will also build a line up the South Llano River to Rock Springs, where it will connect with the electric plant in that town, where it proposes to establish a 400-acre demonstration farm, using electricity to operate the irrigation pumping plant and for other purposes.

CAMERON, TEX.—The properties of the Cameron Water, Power & Light Company have been acquired by the Texas Power & Light Company, Dallas. A 60,000-volt transmission line will be erected from Temple to Cameron.

GAINESVILLE, TEX. — The Texas-Louisiana Power Company, Fort Worth, has acquired the plant of the Gainesville Ice Company, and the property of the Crystal Bottling Works and the Crystal Ice Cream Company. The company plans extensive improvements in this part of the state, which will include the erection of a high-tension line from Nocona to Muenster. The power plants at Saint Jo, Pilot Point, Sherman and Nocona have recently been acquired by the company.

HOUSTON, TEX.—The Western Union Telegraph Company has started work on an extensive underground conduit system connecting all branch offices with the main office.

HOUSTON, TEX. — A budget of the Houston Lighting & Power Company calling for an expenditure of $2,734,353 for extensions and improvements has been approved by the Public Service Commissioner. The work will consist of the installation of a 30,000-kw. turbo-generator at the Deepwater plant, two underground circuits to serve the business section of the city, meters for street-lighting systems, short line extensions, etc.

MARSHALL, TEX.—Work will begin at once on the erection of a 6,600-volt transmission line from Marshall to Hallsville, a distance of 12 miles. Electricity will be served to consumers along the line as well as in Hallsville.

SAN ANGELO, TEX. — Three electric transmission lines, one to serve the shallow water belt northwest of San Angelo, the town of Carlsbad and the Carlsbad State Sanatorium; the second to Mullen and the third to Seven-Mile Bridge, both to supply power to irrigation pumps, will be erected by the West Texas Utilities Company from San Angelo, early this year. The Carlsbad line will carry 33,000 volts and the other two 2,300 volts. Extensions will be made to the local electric plant. The company also plans to build an ice plant here, to cost about $200,000. The total cost of the proposed work is estimated at between $750,000 and $1,000,000.

Pacific and Mountain States

COWICHE, WASH.—Steps have been taken by the Commercial Club for the installation of an improved lighting system in different parts of the city.

SEATTLE, WASH.—Plans for the proposed works of the Best Universal Lock Company, 1121 Post Street, to be erected at First Avenue, South, and Dawson Street,

to cost about $500,000, include a power plant. John Graham, Dexter Horton Building, is architect.

PORTLAND, ORE.—The City Council is considering the installation of an improved lighting system on Sixth Street from Burnside to Jefferson Street.

PORTLAND, ORE.—Extensions and improvements are contemplated by the Portland Electric Power Company, involving an expenditure of about $2,200,000 during 1926. The work will include extensions to the overhead and underground distribution systems, to cost about $1,000,000; installation of a 20,000-kw. steam-turbo unit at Station L steam plant in Portland, $560,000; improvements to the hydro-electric plant in Oregon City, $150,000; rebuilding a portion of the wood flume at the Bull Run plant, $100,000; rebuilding Jefferson Street substation, $200,000, and building a new high-tension transmission line from Portland to St. Helens, etc., $200,000.

ST. HELENS, ORE.—The St. Helens Pulp & Paper Company will soon start work on the construction of a power plant at its proposed local pulp and paper mill. The cost of the project is estimated at $1,000,000.

TROUTDALE, ORE. — The Rose City Nursery Company plans to build a power plant at its local properties, to cost about $50,000.

MANTECA, CAL.—The Pacific Gas & Electric Company, San Francisco, is planning extensions to its local substation.

OAKLAND, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to build a substation and distributing plant in the vicinity of High Street.

OROVILLE, CAL. — Preliminary plans are being prepared by the Hammon Engineering Company, Insurance Exchange Building, San Francisco, for generating electricity in connection with the Oroville-Wyandotte Irrigation District, taking water from the south fork of Feather River and Dry Creek in Butte County, to develop from 69,170 hp. to 75,000 hp. The cost is estimated at $4,000,000. S. J. Norris, Oroville, is engineer.

SACRAMENTO, CAL. — Plans for the proposed local factory of the American Can Company, San Francisco, to cost about $1,000,000, include a power plant. Headquarters are at 120 Broadway, New York.

SAN BERNARDINO, CAL.—The City Council has approved the installation of ornamental lamps on Mount Vernon Avenue from Mill Street to the south city limits.

SAN FERNANDO, CAL. — Plans are under way by the Board of County Supervisors, Los Angeles, to build an addition to the power plant at the Olive View Sanitarium, near San Fernando.

TULARE, CAL.—Work will be started at once by the Southern California Edison Company, Los Angeles, on the construction of a 10,000-volt distribution substation in the Tulare district. The cost is estimated at $90,000.

PHOENIX, ARIZ.—The Chloride Mining Company plans to install electric power equipment at its proposed custom milling plant, to cost about $400,000.

COLORADO SPRINGS, COLO.—Plans are being prepared by the Board of Trustees of the Colorado School for the Deaf and Blind, for a power plant at the institution, to cost about $43,000. Elmer E. Nieman, 218 East Dale Avenue, is architect.

RIFLE, COLO.—The Vanadium Corporation of Colorado, Grand Junction, plans to install electric power equipment in the proposed addition to its local vanadium mill, to cost about $250,000.

Canada

VICTORIA, B. C.—The Pacific Grain Terminals, Ltd., plan to install electric power equipment in its proposed local grain elevator, to cost about $1,000,000.

FONTHILL, ONT.—The installation of an electric distribution with substation, etc., to cost about $25,000, is under consideration by the village officials.

MONTREAL, QUE.—Plans for extensions and improvements of the Bell Telephone Company of Canada for 1926 provides for an expenditure of $17,500,000, of which $5,980,000 will be used for central office equipment; $4,840,000 for station equipment; $4,750,000 for exchange lines; $1,270,000 for land and buildings, and $700,000 for long distance lines.

ROUYN, QUE.—Surveys are being made by the Northern Canada Power Company, Timmins, for a transmission line from the Quinze power plant to the Normanda mines in Rouyn.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 22, 1925)

1,566,565. METHOD OF EQUALIZING PAIRS OF SELF-INDUCTION COILS; E. Schürer, Cologne-Mulheim, Germany. App. filed March 28, 1922.

1,566,618. AUTOMATIC ELECTRIC FLATIRON; M. S. Runsvold, San Diego, Cal. App. filed Aug. 11, 1924. With quick-break thermostatic switch mechanism.

1,566,622. TELEPHONE SYSTEM; W. G. Shull, Chicago, Ill. App. filed Sept. 28, 1921.

1,566,657. WIRELESS TRANSMITTER; W. T. Ditcham, Lebanon Park, England. App. filed Dec. 18, 1920.

1,566,674. ELECTRIC BRAZING APPARATUS; F. J Horta, Oakland, Cal. App. filed Feb. 11, 1922.

1,566,680. SENDING ARRANGEMENT; A. Meissner, Berlin, Germany. App. filed Sept. 3, 1921.

1,566,693. MAGNETO-ELECTRIC MACHINE; O. Pletscher, Albisrieden, near Zurich, Switzerland. App. filed April 11, 1922.

1,566,694. METHOD OF ELECTRICALLY PRODUCING ALUMINUM; J. B. Railsback, Shreveport, La. App. filed Oct. 20, 1924.

1,566,699. THERMOSTATIC CONTROL; E. A. Scholtz, San Francisco, Cal. App. filed April 22, 1924.

1,566,756. HIGH-TENSION SWITCH; J. N. Mahoney, Brooklyn, N. Y. App. filed June 14, 1921. Using an arc-quenching fluid; adapted to control circuits of relatively high potential.

1,566,772. HEATING SYSTEM; A. F. Roth, Newark, N. J. App. filed Aug. 29, 1923.

1,566,781. ADAPTER FOR CONNECTING DEVICES; G. C. Thomas, Jr., Elizabeth, N. J. App. filed May 4, 1921.

1,566,804. ELECTROLYTIC-CELL BATTERY; W. E. Mortrude, Jr., Seattle, Wash. App. filed Aug. 13, 1924.

1,566,848. INCANDESCENT LAMP; G. R. Fonda, Schenectady, N. Y. App. filed Jan. 26, 1922. Having material introduced in bulb to prevent discoloration.

1,566,852. CARTRIDGE FUSE, KNIFE-BLADE TYPE, FOR RENEWABLE-FUSE ELEMENTS; J. B. Glowacki, Chicago, Ill. App. filed Aug. 8, 1923. With fuse element which cannot be increased in capacity.

1,566,855. ELECTRICAL FURNACE; A. Grauel, Kitchener, Ontario, Canada. App. filed April 30, 1923.

1,566,872. WATER-TURBINE GENERATOR; S. Ishizaka, Kochi-Ken, Japan. App. filed Aug. 25, 1924.

1,566,879. METERING SYSTEM; V. Karapetoff, Ithaca, N. Y. App. filed March 7, 1922. Measurement of unbalanced conditions in multiple-line-supply systems.

1,566,902. INDUCTION METER; Z. Ciffrinowitsch, Berlin, Germany. App. filed Oct. 16, 1922.

1,566,935. ELECTRIC SWITCH; H. Trencham, Ruislip, England, and H. C. Heath, Wemberley, England. App. filed Oct. 22, 1923. Truck type.

1,566,936. ELECTRIC POWER SYSTEM; P. Trombetta, Schenectady, N. Y. App. filed March 19, 1924. Power supplied to a load device, as the propeller motor of a ship, from a plurality of generators driven by independent prime movers.

1,566,939. DYNAMO-ELECTRIC MACHINE; A. F. Welch, Fort Wayne, Ind. App. filed Nov. 13, 1923. Improvement of magnetic circuit.

1,566,941. ELECTRIC MOTOR FOR WARNING SIGNALS; F. G. Whittington, Chicago, Ill. App. filed Sept. 13, 1920.

1,566,975. ELECTRICAL FITTING; H. I. Scharr, Washington, D. C. App. filed July 17, 1924. Conductor junction or connecting device for use in the wiring of buildings.

1,566,980. REGULATOR FOR ELECTRIC HEATERS; J. A. Seede, Schenectady, N. Y. App. filed May 7, 1924.

1,566,986. FOOT-REST ELECTRIC HEATER; L. Simmons, Washington, D. C. App. filed April 3, 1925.

1,566,987. ELECTRIC WARMER FOR THE FEET; L. Simmons, Washington, D. C. App. filed May 19, 1925.

1,566,989. ELECTRIC HEATER; M. Skolnik, Minneapolis, Minn. App. filed Oct. 13, 1924.

1,567,012. ELECTRON-DISCHARGE APPARATUS; H. P. Pilon, Paris, France. App. filed April 27, 1922.

1,567,015, 1,567,016, 1,567,017. AUTOMATIC-RECLOSING-CIRCUIT-BREAKER SYSTEM; O. C. Traver, Schenectady, N. Y. Apps. filed Dec. 20, 1921, and Jan. 19, 1922.

(Issued Dec. 29, 1925)

16,237 (reissue). SPECIAL SERVICE TRUNK FOR AUTOMATIC TELEPHONE SYSTEMS; T. G. Martin, Chicago, Ill. App. filed July 9, 1917.

1,567,032. CONVERTING AND TRANSFORMING ELECTRIC CURRENTS; J. E. Calverley, Preston, England, and W. E. Highfield, London, England. App. filed Dec. 13, 1921. Conversion of alternating current from a polyphase system of one number of phases to another polyphase system of a different number of phases.

1,567,040. TELEPHONE-EXCHANGE SYSTEM; E. H. Clark, Richmond Hill, N. Y. App. filed Dec. 6, 1923. Automatic.

1,567,041. TELEPHONE-EXCHANGE SYSTEM; R. O. Covell, Philadelphia, Pa. App. filed Feb. 28, 1924. Machine switching.

1,567,042. TELEPHONE-EXCHANGE SYSTEM; G. Deakin and L. Polinkowsky, Antwerp, Belgium. App. filed Oct. 16, 1923. In which preference is given to toll calls over local calls.

1,567,053. STEPPING MECHANISM; F. H. Hibbard, Arlington, N. J. App. filed March 3, 1924. Step-by-step movement of a selector switch in automatic-telephone systems.

1,567,054. AUTOMATIC-TELEPHONE SYSTEM; E. E. Hinrichsen, New York, N. Y. App. filed March 30, 1922.

1,567,055. ELECTRIC LAWN MOWER; E. Huff, Boyceville, Wis. App. filed March 28, 1925.

1,567,060. TELEPHONE-EXCHANGE SYSTEM; L. Keller, New York, N. Y., and S. B. Williams, Brooklyn, N. Y. App. filed March 31, 1923. Machine switching.

1,567,069. ALLOTTER-CONTROLLING SYSTEM; A. E. Lundell, New York, N. Y. App. filed Sept. 21, 1923. For telephone-exchange system.

1,567,072. TELEPHONE-EXCHANGE SYSTEM; W. H. Matthies, Hackensack, N. J. App. filed Oct. 16, 1924. Automatic.

1,567,087. TELEPHONE-EXCHANGE SYSTEM; P. C. Smith, East Orange, N. J. App. filed Oct. 12, 1923. Automatic.

1,567,094. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Brooklyn, N. Y. App. filed Oct. 23, 1922. Automatic.

1,567,104. SWITCH-OPERATING DEVICE; M. J. Beck and C. L. Beck, St. James, Minn. App. filed Feb. 1, 1923. For operating the electric lights in a sleeping room simultaneously with the operation of an alarm clock.

1,567,122. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; B. G. Dunham, Chicago, Ill. App. filed Oct. 5, 1904.

1,567,128. WIRE PROGRAM-TRANSMISSION SYSTEM; C. H. Fetter, Millburn, N. J. App. filed Sept. 18, 1923.

1,567,140. MERCURY-TUBE SWITCH; W. G. Martwig, Chicago, Ill. App. filed May 11, 1923.

1,567,155. ELECTRIC CONNECTOR; I. W. Litchfield, Newtonville, Mass. App. filed May 7, 1921. Clip type.

1,567,167. FOUR-WIRE REPEATER CIRCUITS; H. Nyquist, Elmhurst, N. Y. App. filed July 8, 1921.

1,567,176. ATTACHMENT PLUG; R. B. Benjamin, Chicago, Ill. App. filed Feb. 6, 1920.

1,567,186. WATER PURIFIER; F. Kraemer, Los Angeles, Cal. App. filed Dec. 3, 1923.

1,567,187. MULTIPLE-FUSE PLUG; C. Lay, San Antonio, Tex. App. filed Oct. 21, 1924.

1,567,201. INSULATED CONNECTER; L. Steinberger, Brooklyn, N. Y. App. filed April 11, 1919. Bushing; provided with an oil insulator within the body.

1,567,204. RADIO-TRANSMITTING SYSTEM; J. S. Stone, San Diego, Cal. App. filed Jan. 29, 1925.

1,567,208. PROGRAM TRANSMISSION OVER WIRES; J. F. Toomey and H. E. Phelps, New York, N. Y. App. filed Nov. 11, 1922.

1,567,209. SUBSCRIBER'S EQUIPMENT FOR PROGRAM TRANSMISSION; J. F. Toomey, New York, N. Y. App. filed Dec. 1, 1923.

1,567,217. DYNAMO-ELECTRIC MACHINE; H. Weichsel, St. Louis, Mo. App. filed March 22, 1924. Self-excited synchronous motors, self-excited compensated asynchronous motors and converters of the polyphase or single-phase type.

1,567,223. CONTROLLING SYSTEM; W. P. Albert, East Orange, N. J. App. filed June 17, 1922. Employed in automatic and semi-automatic telephone-exchange systems.

1,567,230. DEVICE FOR ELECTRICALLY REPRODUCING SOUNDS; O. Bothe, Steglitz, near Berlin, Germany. App. filed March 23, 1922.

1,567,231. TELEPHONE-EXCHANGE SYSTEM; L. J. Bowne, Howard Beach, N. Y. App. filed July 26, 1922. Arrangements for signaling over toll lines.

1,567,236. TELEPHONE SYSTEM; E. D. Butz, Palisade Park, N. J. App. filed July 31, 1923. Automatic.